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WORLD CROPS

The International Journal of Agriculture

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A Publication of The Leonard Hill Technical Group

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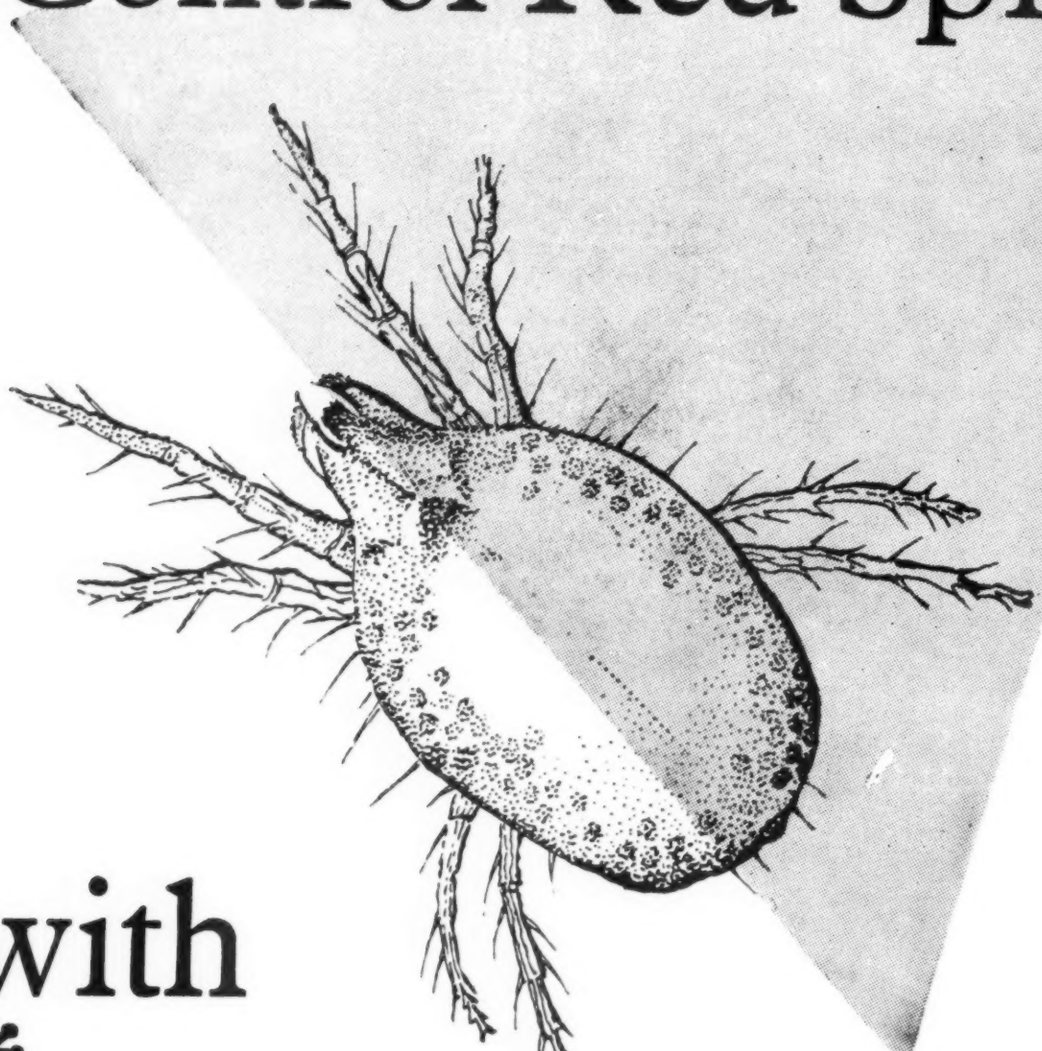

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Editorial Comment

Building for the future

FEW PEOPLE realise the importance of paper. Everything from land deeds to FAO publications, from agricultural enactments to the publication of your International Journal of Agriculture, WORLD CROPS, involves the consumption of vast quantities of that almost-forgotten commodity, paper pulp. This crude raw material is an essential factor in modern existence and one may well wonder what the world would be like without it.

We, who have had the interesting experience of life in a prison camp, where supplies of paper were practically non-existent, know that you can get on without paper if you are content to live a primitive existence. Gone was the red tape and with it the elaborate filing systems; gone were regimental orders and the blandishments of income tax officials ; there were no letters to answer and, of course, no writing paper or envelopes to answer with.

So valuable was paper that *in extremis* we sold a copy of the Holy Bible, from cover to cover, at ten cents a sheet to buy crude red palm oil with which to lubricate our plain boiled rice and provide essential vitamin A. The leaves of paper were bisected to make two thin sheets of cigarette paper and the tobacco consisted of cherry leaves, papaya leaves or, at best, dried grass, impregnated with nicotine, otherwise known as ' Sikh's beard '. In this care-free existence we enjoyed three ' square ' meals a day and went about our work modestly dressed in a ' Jap-happy ' and wearing crude clompers. Such, then, is life *without paper*.

To return to our theme, the basic raw material for the production of paper pulp is the spruce fir, mainly to be found in Scandinavian countries and in Canada. No less than 70% of the world's supply comes from Newfoundland and Canada; last year 10 million tons of newsprint were consumed and by 1965 it is estimated that the world's need for newsprint will be about 15 million tons, worth at today's price about £1,000 million. The spruce fir takes about 40 years to reach maturity and the present rate of replacement is not keeping pace with the present rate of consumption. Paper prices are rising steeply. It is quite obvious that the rate of replanting needs to be progressively increased or there will be a paper famine in a few years' time. Much more money needs to be given to this long-term investment, but instead vast sums of money are invested in defence preparations, in the development of nuclear energy and in ' reaching for the moon '.

This estimate for newsprint requirements does not take into account the increasing demands from countries which are at present backward and where, at present, over 80% of the population cannot read (even though they have a vote!). There is a never-satisfied demand for education in the world, and particularly in the field of agriculture, for the operations of agricultural organisations, such as FAO, the Colombo Plan and the South Pacific Commission, not to mention the work of the various Departments of Agriculture, are stultified if there are no books, if the people cannot read the simplest leaflets, and their destinies remain in the hands of the privileged few, who can.

The problem of ensuring adequate supplies of timber to meet the ever-growing needs of an ever-increasing world population is almost as important as meeting the world's needs of food and water—it is certainly much more important than the race to take possession of the moon—to be the first to plant the American, the Russian, or maybe even the German, British or French flags on this new and desolate colonial or satellite possession.

It is possible that new raw materials for the making of paper need to be discovered, but, in any case, more and more money will be needed for research in forestry, for replanting and for new planting to ensure a steady increase in the future supplies of this essential commodity.

There are in Britain small areas of waste land and marginal land which, in total, represent a vast acreage. A ' national ' tree-planting campaign, organised by the ' Men of the Trees ', could have a considerable influence in increasing the tree population and in beautifying the countryside. Already in Ceylon there have been tree-planting campaigns, and it is customary to mark a birth by planting a coconut palm.

'Men of the Trees'

THE ' MEN OF THE TREES ' is a world-wide fellowship of tree lovers whose aims are to prevent the destruction of much of the world's natural beauty through indiscriminate felling and to encourage the growing of trees, upon which the life and well-being of mankind so largely depends. In the 30 years of its existence the ' Men of the Trees ' has saved for posterity many trees and woodlands and has influenced large-scale reafforestation both at home and abroad. But for its timely aid some of the finest remaining redwood groves of California would have fallen to the axe.

We are of the opinion that many of today's major problems are directly due to ignorance of the importance of trees in our lives. Millions of acres of rich farmland are now deserts as a result of the wholesale destruction of wood and forest land. The dust bowls of America, Africa, Australia and the now unproductive areas in this country are tragic evidence of the results

of ignorance. Trees conserve watersheds, prevent wind devastation and hold back the encroaching sea.

The Society has achieved considerable success in creating a tree sense in many parts of the world. *It is now collaborating with representatives of* 34 *countries for a World Charter for Forestry to fight the menacing encroachment of desert conditions upon the already inadequate food resources of the earth.*

Planting and replanting

LAST YEAR saw the close of the first decade of post-war forestry in Britain and, where the Forestry Commission was concerned, marked the planting of the millionth acre of forest. This, we consider, was no mean achievement, when one takes into account the vicissitudes that have beset the Commission since its inception in 1919, including the advent of the second world war, which put the emphasis on felling and severely restricted planting.

A major difficulty still persists and, but for this, planting progress by the Commission would undoubtedly have been much greater. It is the problem of a shortage of suitable land for planting. The total afforestation and replanting proposed for the Commission in the first post-war decade was 900,000 acres, but actual achievement produced only 548,000 acres, or 61% of the programme. It was proposed that 1,850,000 acres of plantable land should be acquired, but only 493,000 acres, or 27% of the total, were obtained. On analysis it may seem surprising that so high a figure of planting was accomplished while acquisitions were so low, but the explanation is that when the post-war programme was embarked upon the Commission had a comparatively large reserve of land in hand.

The Forestry Commissioners have stated that it is not the total size of their programme—*three million acres to be planted by* A.D. 2000—but the rate of achieving it that was originally set too high. At the same time, the Commissioners have affirmed their belief that, from an economic and social standpoint, the original intention to provide from home sources—that is, from Commission and private woodlands—one-third of the country's pre-war consumption of wood in all its forms is a realistic objective.

The Commission's problem is not easily solved, but we understand that it intends to maintain its efforts to secure a greater flow of land by voluntary purchase, or lease. We believe that with a growing awareness of the importance of forestry, which can raise the productivity of much of the hill land which at present is not being put to its best use, acquisitions could be stepped up. We note that private planting, which largely involves the restocking of old woodland and does not carry with it the problems of land acquisition, has also made encouraging progress. In the decade 165,000 acres, or 82% of the 200,000-acre programme, were planted.

The language barrier

WE HAVE received some valuable comments from a scientist of world repute on our recent editorial, 'The language barrier' (WORLD CROPS, 1957, **9**, 439). In considering the organisation of international conferences, he considers that it is necessary to distinguish between the purely scientific conference and the conference which has a strong technological flavour. For instance, an international botanical conference must inevitably be split up into a large number of sections; this does not matter, as almost every scientist is today a specialist and will, on the whole, stick to his special interests. In contrast, in the case of a more general scientific conference, the business men, agricultural advisers and technological experts, especially those from industry, tend to be far less specialised, and therefore the problem of overlapping sections and the need to have a single building which can accommodate all the sections becomes much more acute.

It can be taken as axiomatic that the larger the number that will be attending a conference, the more it will need to be subdivided into sections, and if the meeting places are to be conveniently grouped there are only a few places in the world where such conferences can be held. One way of solving the problem is to have a cycle of smaller conferences, one which deals, say, with insects and insect control, plant pathogens and their control, and, thirdly, weeds and weed control.

Another suggestion he makes is to plan the programme as a symposium, so as to deal with general principles having implications in all branches of crop protection. This type of conference would be more difficult to plan, as it would be necessary to invite expert contributors to give a group of papers on the set subject—and for this ample funds will have to be available.

On the question of language, the professor states that most academic scientists do have a smattering of foreign languages and can manage where the papers are given in English, French or German, but he doubts whether this is true of the younger scientists, particularly the Americans. This is because a scientific training today requires such intense concentration that there is a real danger of over-taxing the minds of the rising generation.

This, however, applies only to the more advanced countries—a quarter of the world population. The needs of the newly self-governing territories must not be overlooked. *In the rising tide of nationalism there is a strong tendency for them to revert to the native language, or even languages*, so as to provide a democratic (?) equality of opportunity in administrative and political appointments. In these countries there are, as a result of the education received in the new universities, mostly established during the much-abused colonial régime, a considerable number of brilliant scientists,

whose work will be seriously hampered if they are forced to teach and to train young scientists in the language of the country. *The growing gap* (see also WORLD CROPS, 1957, **9**, 90) *between the advanced and the backward nations must continue to widen* if technological advancement is to be denied them because there is still no accepted common world language.

It will be many years before the results of an agreed policy can take effect, but to us the need to make an immediate start is obvious. If a lead is not given, three-quarters of the population of the world must imperceptibly revert to the condition of the Dark Ages which followed the collapse of the Roman Empire. There are signs already that this is actually happening. The challenge to the United Nations is there. It is more important than the giving of material aid or of technical assistance in one form or another. The work of such agencies as FAO, the Colombo Plan, the South Pacific Commission, WHO etc. will become increasingly difficult and unsatisfactory, as all negotiations, speeches and advisory work will have to be done through an interpreter, and the published results of scientific research and other types of investigation in underdeveloped territories will become unreadable to the people most concerned.

Radioactive contamination

THE IMMEDIATE reactions to the first major atomic accident in Britain, at the Windscale plutonium factory on the Cumberland coast, were astonishment and fear. Prompt action brought to a close an incident which should never have arisen, and which might have been very much more serious.

Energy stored in the graphite moderator blocks was released by what is known as the Wigner effect, resulting in an abnormally high temperature, which fired some of the uranium fuel elements. Highly radioactive fission products were thus liberated and the filters in the high stacks were inadequate to cope with the emergency. Although the fire was put out with water, *the whole reactor, worth several millions of pounds, must be considered as virtually a total loss.*

Radioactive iodine and strontium were among the materials which were let loose over the countryside. Unlike the fall-out from a nuclear bomb, which is pushed up to great heights and falls only slowly, these fission products were released near ground level and found their way into soil and crops (see WORLD CROPS, 1957, **9**, 112). Cows grazing locally consumed these active deposits. Thus radioactive iodine found its way into the udder and appeared in the milk, probably as iodinated proteins and fatty acids. Radio-strontium, since it closely resembles calcium, also got into the milk, probably both with the ionised calcium and protein-bound calcium. In any case, the milk became unfit either for direct consumption, or for the making of butter or cheese. All milk produced in the Cumberland area had to be discarded into the sea. The cost involved was, of course, minute compared with the huge financial losses in the reactor itself.

The point of interest to agriculturists is naturally whether such an event is likely to recur, since it means possible health or genetic danger to human beings and wastage of crops and dairy products. Fortunately, a fair degree of reassurance is possible. In the first place the accident was the result of carelessness and insufficient availability of operational information for coping with reactor emergencies. Tightening-up of supervision and regulations might minimise risks of a recurrence. Secondly, the use of an open-cycle air-cooling system at Windscale is antiquated; the escape of fission products cannot occur nearly so readily with closed-cycle gas cooling such as is used in more modern reactors. But the local danger can never be averted completely and we have to resign ourselves to living with such hazards just as we have to face the possibility of air, rail and sea disasters and of military and industrial accidents.

This, unfortunately, is the price we must pay for the privilege of living in the 20th century, which is comparable to living on the fertile slopes of a volcano, such as Vesuvius. The world resources of fossil fuels are not expected to last much beyond the end of the century at the present profligate rate of consumption and, taking into consideration the ever-increasing needs of an ever-growing world population, *research in the field of nuclear energy must go on.* We are fortunate to have received a kindly warning not to take unnecessary risks or relax our vigilance.

Tea and bananas

THE PROSPECTS of these two crops in the Union were discussed in a recent issue of *Farming in South Africa* (1957, **33**, 1, 6 and 38). Tea is no longer grown there, though until ten years ago sizable attempts were being made in Natal to establish a tea-growing industry; tea imports into the Union now represent an annual cost of some £6 million. Dr. A. van der Meulen (Citrus and Subtropical Horticultural Research Station, Nelspruit) considers that, although tea plants will grow in certain favourable parts of South Africa, the economic production of tea is not a sound proposition.

No large-scale crop makes a higher labour demand than tea and in South Africa wage levels and lack of suitable labour would combine to defeat any tea-producing project. The failure of original attempts in Natal was accelerated when Asiatic labour was no longer available. Yields in Natal were less than half those of Ceylon, and generally the rainfall and temperature conditions in the Union would lead to small yields and low quality. Tea can be most hopefully grown only in small and scattered areas in the hills; for that reason it would not be possible to supply a

large factory with raw leaf regularly and economically. Even in Asia, smallholding ventures often give poor economic results for this reason; a large-scale unit of at least 2,000 acres, with its own factory for the necessary complicated processing, is essential.

Prospects for an exporting banana industry in the Union however seem much more promising. Less than ten years ago, Natal was the main centre with 4,000 morgen* under bananas, compared with 800 in the Transvaal; now there are 10,000 morgen in the Transvaal, but in Natal the figure has dropped to 3,000. The increase in the Transvaal is mainly due to irrigation in the Lowveld (see WORLD CROPS, 1957, **9**, 199.)

The cost of production in South Africa is much the same as in Central America and the West Indies, but yields are generally higher. Mr. E. F. Malan, of the Nelspruit Research Station, however, considers that the main requirement of the industry, if it is to take its place in the world market, is the production of better-quality fruit. Fewer bunches of better fruit per morgen will be one step in this direction. An important priority will be the improvement in the methods of handling, packaging and transporting the crop, since in the established banana-exporting countries the standard of post-harvesting operations is generally higher than in the Union. The introduction of other varieties may also be necessary and he has recommended the introduction of 'Gros Michel', 'Lacatan' and 'Giant Cavendish', although there is some doubt whether any of these will be at their best in the fluctuating climate of the Lowveld. However, 'Dwarf Cavendish', already generally grown in the Lowveld, may still prove capable of producing top-quality fruit, with correct cultural treatment, as the climate suits this variety.

Pacific paradise

WELL OFF the beaten track for tourists is Pago Pago —pearl of the Pacific—a land-locked harbour over the site of an extinct volcano—at least we hope it is extinct. It is a self-governing territory, administered by the U.S. Department of the Interior, and with a council of paramount chiefs to advise the Governor on matters of Samoan tradition.

The population has grown from 5,697 in 1900 to 22,400 in 1954—a fourfold increase for an area of only 76 sq. miles, of which only 20% is cultivatable. Imports in 1954 amounted to $992,543 against exports worth $546,237, and this adverse balance of trade has been repeated each year since 1946. The exports, consisting chiefly of copra and amounting to only 1,803 tons, go principally to the U.S.A.

This was the situation which faced Mr. Geo. W. McCormick, the Director of Agriculture, when he arrived three years ago. He quickly realised that the attitude of mind of most Americans to colonial problems, which was to break down the way of life of the people and replace it with the ice box and the electric washing machine was impracticable. So, putting first things first, he established a herd of milking cows, as no milk whatever was produced in the Islands. There was also no organised agriculture. He is now studying various types of Avocado pear produced there and he intends to select one or two, with better yields and flavour, for purpose of export.

It may be remembered that the hero of the 'Teahouse of the August Moon' had a similar experience in his endeavours to implement the 'American Way of Life' among a simple village people, so he settled for a delightful compromise which did not at all meet with official approval.

*A morgen = 2.116 acres

World problems

WE PUBLISH (on the facing page), as is the custom in our January issue, a summarised version of the FAO annual report on the world food and agricultural situation. Since this report was presented FAO has held the Ninth Session of its General Conference at its headquarters in Rome, attended by delegations from 74 member countries. A sound and sober note was struck by Mr. B. R. Sen, the Director-General, when he spoke of the danger that the rate of expansion in agricultural production may be slowed down by the scarcity of investment resources, by a general pause in economic advance and by a fall in agricultural commodity prices. He also made reference to the over-concentration on industry in some under-developed countries having led to some neglect of agriculture. Yet it is in just these countries that the need for expanded food production is greatest, and also most possible, provided the capital for development is allocated, either by external grants-in-aid or by internal budgeting. (God also helps those who help themselves!)

The problem of crop surpluses was naturally considered. The President of the International Federation of Agricultural Producers, Mr. J. Andrew, said that his organisation felt there was some lack of international co-operation and too much cautiousness in the use of surpluses in development programmes, and that there should be greater international consultation. *Here, indeed, is a field for unselfish and constructive international co-operation to devise some machinery that will ensure that no man goes in want of food while the silos of the big producing countries are filled to overflowing, and that at the same time the international wheat market will not collapse* (see WORLD CROPS, 1957, **9**, 360—World Pool).

'Spudnik'

THE NATIONAL Potato Chip Institute, Cleveland, Ohio, U.S.A., is searching for 'Spudnik', the world's largest potato. The winning entry will be displayed at the 21st annual conference of the Institute at Hollywood, from 22-26 January.

THE WORLD FOOD AND AGRICULTURAL SITUATION*

Over the last few years food production has increased at the rate of about 3% annually, or rather more than 1% faster than the growth of world population. It has increased rather more quickly in the less developed regions than in the rest of the world, and although this is largely offset by the more rapid growth of populations, indications are that they have at least held their own. But, although the threat of actual famine has receded, inadequate and unbalanced diets are still the common lot of more than half the world's population.

Rice

THE main recent trends in the world food and agricultural situation were continued in 1956–57 and production again increased by about 3%. As in 1955, the volume of world trade in agricultural products rose sharply. Reflecting intensified surplus disposal operations, which contributed substantially to the sharp upward movement in the volume of world trade, surplus stocks rose only slightly in 1956–57 and for some products began to decline; once again, however, stocks of coarse grains were a major exception.

Production

The increase in world agricultural production in 1956–57 was fairly evenly distributed among the different regions, except for Oceania, where it appears that the greatly increased level of the previous year was not quite maintained. Since 1948–52, the increase in production in each of the less developed regions has been above the average for the world as a whole, while increases in the developed regions have generally been less rapid. Nevertheless, in the Far East and Latin America, the substantial progress achieved has not yet been sufficient to overcome the setback of the war years.

World production (excluding the U.S.S.R., Eastern Europe and China) in 1956–57 exceeded estimates by about 3% and, in fact, the targets were actually reached a year earlier than expected. The only region where production fell appreciably short of estimates was Latin America, where the targets had been set rather high because of particularly rapid population growth.

World production exceeded expectations, in some cases substantially, for most commodities, and only for five main commodities (wheat, cotton, bananas, rubber and eggs) were the expected levels of production not reached.

Present indications are that in 1957–58 world agricultural production will continue to increase at approximately the same rate as in the last few years.

Cotton

Wheat

Commodity survey

Total supplies of grains were again larger in the 1956–57 trade season. World production of *wheat* decreased slightly, exports rose sharply to reach a post-war peak and U.S. stocks began to decline. Exports of *coarse grains* were below the record levels of 1955–56, but production showed a further sharp increase, most of which was transferred to stocks. For 1957–58 prospects depend mainly on the outcome of U.S. harvests; it already appears that the large reduction in wheat acreage will be almost completely offset by higher yields. *Rice* production, consumption and trade all increased in 1956 and exportable stocks were again considerably reduced.

The consumption of *sugar* rose more rapidly than production in 1956, stocks were drawn on substantially and the world price rose very sharply.

World production, consumption and trade in *fats, oils and oilseeds* increased

* A summary of the report to the FAO Council '*The State of Food and Agriculture*, 1957'

in 1956. International market prices, especially of drying and liquid edible oils, have been exceptionally unstable since the beginning of 1956. Exports remained large in 1957 and some of the price rises of last year may be maintained.

Of the major varieties of *fresh fruit*, the market for citrus continues to be affected by the severe frost damage in Spain in early 1956, but the production of table apples recovered sharply from the low level of 1955. The production of most types of *dried fruit* increased, but output of dates was unusually low in Iraq. *Wine* production decreased slightly, with large reductions in some European countries because of the effects of the frost.

The output of *cocoa* increased very sharply in 1956–57. Consumption, after falling to a very low level in 1955, has been increasing steadily since the end of 1956 and the long downward price movement has finally been reversed. World *coffee* production declined from the 1955–56 record; with stronger demand, imports continued to increase and prices remained steady at a comparatively high level. World *tea* production rose only slightly, but there was a sharp increase in exports as well as rising domestic consumption in producing countries.

Tobacco output increased slightly; U.S. exports were reduced and there was a further rise in stocks. In 1957–58 U.S. production should fall as a result of much lower acreage.

World *cotton* production turned downward in 1956–57, mainly because of acreage reductions in the U.S.A. *Jute* production and consumption appear to have been roughly in balance in 1956–57, but prices advanced rapidly toward the end of 1956. Output of all major *hard fibres* increased; consumption prospects appear favourable.

The production of natural *rubber* declined slightly from the 1955 peak and was exceeded by consumption; prices showed considerable fluctuations during 1956 and early 1957.

The rapid increase in the output of *forest products* slowed down in 1956, total fellings being approximately the same as in the preceding year, but a renewed expansion is expected in 1957. World trade in pulpwood and pit props declined, but prices continued stable. Requirements of sawn wood were lower in Europe and North America, total world trade also declined and there was some weakening in prices. The steady post-war expansion of wood pulp production and trade continued, however, and newsprint also registered a further sharp increase.

Stocks

The rate of growth of world stocks has slowed down considerably since 1954 and there was only a small overall increase during 1956–57. After an uninterrupted rise for some years, the investment in surplus stocks of the U.S. Commodity Credit Corporation began to decline. There was a fall in U.S. stocks of wheat and cotton, but North American stocks of coarse grains rose very sharply and now exceed the wheat stocks of the four major exporters.

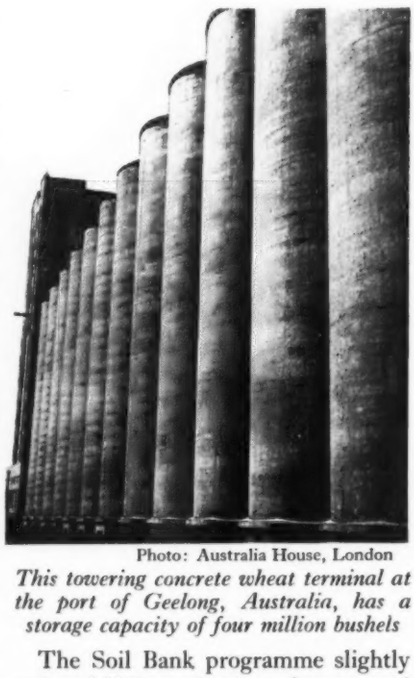


Photo: Australia House, London

This towering concrete wheat terminal at the port of Geelong, Australia, has a storage capacity of four million bushels

The Soil Bank programme slightly reduced U.S. production of cotton and some coarse grains in 1956–57, but both acreage and production of wheat were higher. The decline in U.S. stocks of certain commodities primarily reflected the intensification of surplus disposal operations.

Farm prices

As a result of the continued tendency of prices to move against farmers, reinforced in some countries by lower output in 1956–57, aggregate net farm income again declined in a number of countries. In other countries production rose sufficiently to outweigh the price movement, so that increases in farm income, sometimes reversing a steady downward trend, were rather more widespread than in the past few years.

Declines in farm income would almost certainly have been more frequent and more pronounced but for the use of price supports in many countries. Under many systems of price support, this necessitates increased governmental intervention in international trade, either by restricting imported supplies to maintain domestic prices at support levels, or by the direct or indirect subsidisation of exports.

Consumption

Recent developments and studies bring out the essential connection between general economic development and nutritional improvement.

In the wealthier countries, and everywhere at high income levels, an increase in *per caput* income leads to a relatively small increase in food expenditure. For some foods, indeed, consumption tends to decline as incomes rise above a certain level, more expensive foods being substituted.

At low income levels, on the other hand, and notably in economically under-developed countries, a small rise in income usually results in a sharp increase in food purchases, especially of the so-called protective foods, such as milk, eggs, fish, fruit and vegetables, and hence to a marked improvement in the nutritional quality of the diet.

These facts point to the vast potential market for foodstuffs in the less developed countries of the world. They indicate also the importance in economic planning of making provision for the rapid increase in demand for food as incomes rise above the subsistence level, if inflationary strains are to be avoided. On the other hand, even where average diets are nutritionally inadequate, farm prices may collapse and food surpluses could develop, if food production outruns the growth of demand.

The rapid growth of towns has an important influence on food consumption. In general, diets appear to be nutritionally better in towns than in country areas, largely, though probably not entirely, because of higher urban incomes. But there are many exceptions where there has been a shift to visually more attractive, but less nutritious cereals, or where undue expenditure on processed foods and beverages

of little nutritional value has left little money for more essential foods. Ignorance of even the simplest rudiments of nutritional knowledge is largely responsible, and elementary consumer education, especially in under-developed countries, would go far to raise nutritional levels in both urban and rural areas.

The growth of towns has also thrown an immense strain on the inadequate food marketing and distribution services in under-developed countries. Unavailability of perishable foods, or their availability only irregularly, at high cost, or in imperfect condition, remains a serious obstacle to better nutrition.

Agricultural polices

Changes in agricultural policies and programmes were again rather frequent.

North America.—Recent developments appear to indicate that the U.S. Soil Bank Programme, instituted in 1955–56, and the system of flexible price supports, may not be able to bring about a sufficient temporary reduction in output for surplus stocks to be eliminated. New proposals are therefore under consideration for further changes in U.S. crop control mechanisms and price support system.

Oceania.—The main emphasis in the field of agricultural policies during 1956–57 has been on trade relations. Both Australia and New Zealand sent trade missions to the U.K. and negotiated agreements modifying and supplementing the Ottawa Agreements of 1932.

Western Europe.—The governments of six Western European countries have signed a treaty, now awaiting ratification, for the establishment of a Common Market, which would include also their overseas territories. A Free Trade Area, to include additional Western European countries, is also under discussion, while similar trade agreements are being considered in some other regions.

Eastern Europe.—In the U.S.S.R., and particularly in the Eastern European countries, there have been some important changes in the organisation of agricultural production and distribution, mainly as a result of growing consumer pressure. *Increased reliance is being placed on contract sales and the incentive of higher prices rather than on the compulsory delivery system*, which during 1956–57 suffered a considerable setback in most of the Eastern European countries. An intensified collectivisation drive was halted in most Eastern European countries because of growing resistance in the countryside; while collectivisation remains the ultimate objective its implementation has been markedly slowed down in several countries.

Photo: Canada House, London

An aerial view of a vast expanse of wheatfield in Canada with the Rocky Mountains in the background. A combine-harvester and tractors are working in the foreground

Elsewhere good progress in the implementation of agricultural development projects has continued, but the revision or postponement of such plans and projects has been rather frequent.

Agricultural organisation

Considerable changes in some of the more important institutional factors affecting agriculture have taken place in the post-war years.

The changes in land tenure concern the ownership pattern, the owner-tenant relationship, and the layout and size of farm units. Changes in the ownership pattern have involved principally the elimination of the large landowners and intermediaries and the absorption of medium- and small-size holdings through collective land use or State farms.

In some countries changes in ownership of forests took place, due to a policy aimed at State or community appropriation of private forest holdings. Another tendency has been that of ensuring a greater degree of State administrative control over unclassed forest lands.

Agricultural credit

Technological, political and sociological changes have increased the demand for agricultural credit in the post-war period. Government facilities have greatly expanded, but non-institutional sources have remained the main reservoir for financing, particularly in under-developed countries.

The various credit institutions, such as village banks, commercial banks, governmental institutions (agricultural banks, special mortgage banks and finance and development corporations) have expanded at a varying rate in the different regions of the world. The supply of loanable funds from these sources has grown slowly since 1951.

The main obstacle remains the shortage of capital and the insufficiency of these credit institutions. These impediments, together with others, such as poor systems of land tenure, point to the great rôle governments have to play, particularly with respect to supervised credit and in connection with land policies.

In the years since the second world war, farmer co-operatives have multiplied throughout the world. The increased awareness of governments of the potential importance of co-operatives is exemplified by the number of countries, especially in Africa, Asia and Latin America, which have enacted legislation specifically for the regulation and encouragement of co-operatives.

Coming Events—a Special Announcement

In this issue we are pleased to announce that this journal is to sponsor an important exhibition in the field of agricultural chemicals—the CROP PROTECTION AND PEST CONTROL EXHIBITION. It will take place from 12 to 15 May, 1958, at the Royal Horticultural Society's New Hall, Westminster, and will undoubtedly be the most comprehensive specialised display of this kind ever to be held.

The support of Government Departments and of a number of associations is being invited and it is anticipated that there will be some 60 or 70 trade exhibitors. More than half of the available stands have already been booked.

Although the Exhibition will be mainly agricultural and horticultural, it will also cover industrial and domestic pest control. Chemical products and services on show will include herbicides, acaricides and insecticides, fumigants, rodenticides, fungicides, seed treatments, sprayers and other applicators, flame-guns, traps, insect repellents, bird repellents, aircraft spraying and other protective services.

It is anticipated that the Exhibition will be attended by large numbers of farmers, foresters, planters, market gardeners, amateur gardeners, agricultural advisers and public health officials. An admission charge will be made to the general public, but *all subscribers to WORLD CROPS will be privileged to apply for free admission tickets*. Further information on this will be published next month.

Invitations have already been sent to very many agriculturists and others in overseas countries, but any of our overseas readers who do not receive invitation tickets will gladly be supplied with tickets and full details on application to the Exhibition Organiser, Crop Protection and Pest Control Exhibition, Leonard Hill House, Eden Street, London, N.W.1. Information can also be supplied on travel facilities to the U.K., on other events taking place in Britain at the time of the Exhibition, and similar matters.

Work Study.—A conference organised jointly by the Association of Agriculture the British Institute of Management and the Institution of British Agricultural Engineers will take place on 19 February, 1958, at 21 Tothill Street, London, S.W.1. Its purpose is to provide a full-scale opportunity for the exchange of information between industry and agriculture on the important subject of making the most of time and energy.

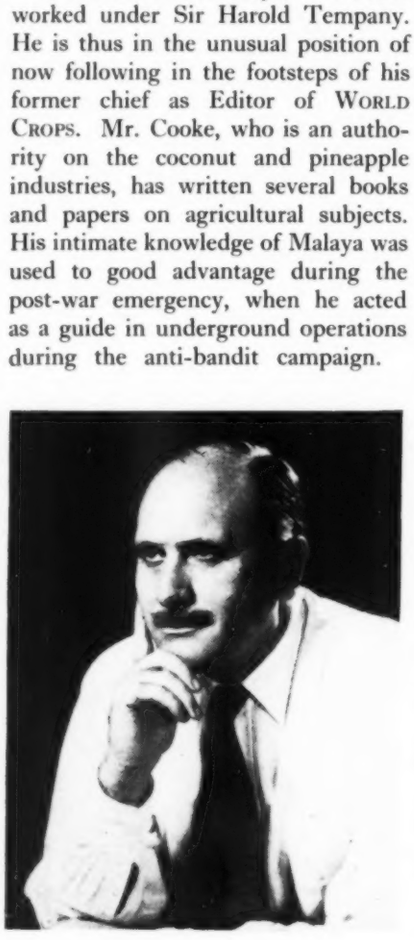
International Agricultural Machinery and Equipment Exhibition.—This exhibition will be held from 4–11 May, 1958, in Brussels, Belgium. Enquiries should be addressed to the Secretary, 29 rue de Sap, Brussels 4.

Silage.—An opportunity to study recent developments in machinery and the methods used in silage making will be provided by a National Silage Demonstration on 21 and 22 May, 1958, near Basingstoke, England, to be organised by the Shell Chemical Co. The Advisory Committee includes representatives of the Ministry of Agriculture, the National Institute of Research in Dairying and the National Institute of Agricultural Engineering.

The Editor

Mr. F. C. Cooke, who has now completed a year as Editor of WORLD CROPS, has had long experience in agriculture. He started his career with Unilever and then took up an appointment with the Empire Marketing Board in the Far East. He transferred to the Department of Agriculture in Malaya and eventually became the Director of the Coconut Research Institute of Ceylon. There he founded and edited the *Ceylon Coconut Quarterly*.

When he was in Malaya, Mr. Cooke worked under Sir Harold Tempany. He is thus in the unusual position of now following in the footsteps of his former chief as Editor of WORLD CROPS. Mr. Cooke, who is an authority on the coconut and pineapple industries, has written several books and papers on agricultural subjects. His intimate knowledge of Malaya was used to good advantage during the post-war emergency, when he acted as a guide in underground operations during the anti-bandit campaign.



Forestry in East Africa

The natural forests of East Africa have largely disappeared, making the country almost entirely dependent on exotic species. A number of the most suitable of these come from Australasia and Dr. A. L. Griffith, silviculturist at the East African Agriculture and Forestry Research Organisation, has recently completed a three months' tour of Australasian forests. During his tour he presented a paper to the 7th British Commonwealth Conference on 'planting exotic softwoods in an area with an unreliable climate'.

Samples of some 30 new species of tree seeds will soon be added to the experimental forest plantations of the Organisation to see if they will make suitable timbers for East Africa.

On his tour Dr. Griffith was able to see Australasian trees which he is already growing in Kenya in their natural environment. Gum trees were growing to twice the height they have so far reached in East Africa and he was able to watch the mechanised felling of giants of 300 ft. using a one-man chain. A species of Callitris, which is termite-resistant, he observed to be still termite-resistant when it is cut and dry, since it is used untreated as flooring in Australian homes.

In New Guinea a monkey puzzle tree was growing to the height of 280 ft. with a girth of 30 ft. This tree provides wonderful plywood, flawless and knotless, and is easily handled. Introduced into East Africa three years ago, it has great possibilities.

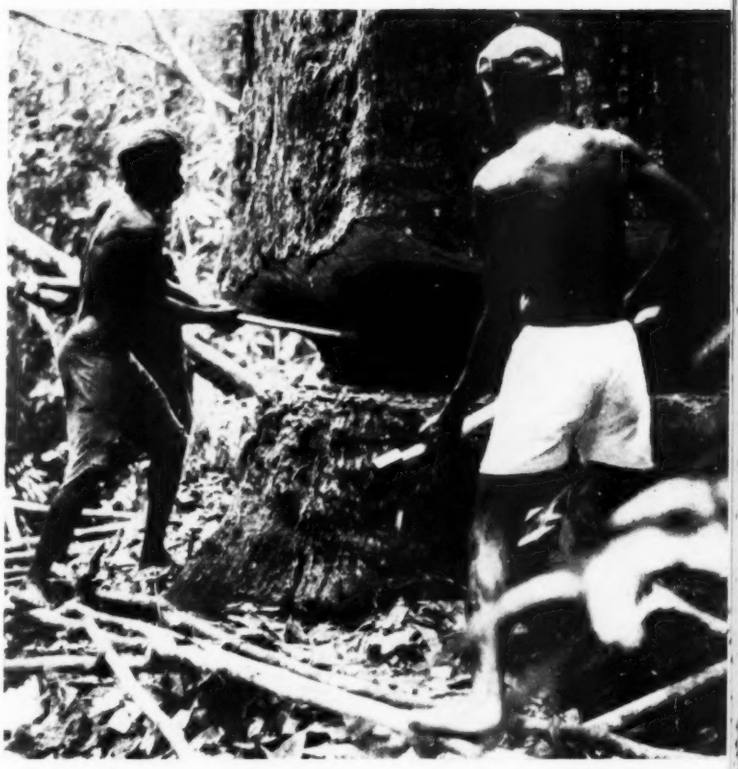
Other promising species he saw growing near Broken Hill, New South Wales, where the rainfall is only 5 in. a year, have great possibilities for the dry areas of East Africa. Among the new species to be sown is a eucalypt from New Britain, which has grown to 130 ft. there in a period of seven years.

INSECT ENEMIES OF TROPICAL TIMBER

D. BOOCOCK

(Technical Director, The Standardised Disinfectants Co. Ltd.)

In cultivated forests in temperate climates, pests can cause such extensive and serious damage that insecticides must be applied over large areas. In the 'natural' rain forests of the tropics, in which a large number of different species grow together, insects attacking the living tree rarely cause much trouble, but when the tree is felled it is usually rapidly attacked. It is with pests attacking tropical timbers, after felling and conversion, that this article is concerned.



A giant of the forest in Ghana

THE felling and extraction of timber may be likened to the harvesting of a crop and during this stage the most important economic pests are the *ambrosia beetles*, which are also called *pinhole borers*. Conversion and seasoning of timber can be compared with processing and storing food or cash crops and at this stage another group of pests becomes active, namely the *powder-post beetles*. Stain and dote, which are caused by fungi, also cause damage of economic importance. As in the fields of agriculture and commodity storage, pests were accepted until quite recently as more or less inevitable and the losses caused unavoidable. To-day, this is no longer the case; an increased demand for high-grade, clear, worm-free timber coupled with lower prices and keener competition has led producers of tropical timbers to extract and market a wide range of species and this tendency has been fostered and often indeed initiated by the forester's natural desire to see the forest wealth fully and properly utilised. The acceptance by timber users and the timber trade of new exotic species has been fostered in the U.K. by the fine work of such organisations as the Forest Products Research Laboratory and the Timber Development Association and was hastened during the war by the absence or shortage of many common timbers. But whereas teak, greenheart, Spanish mahogany and other traditional tropical hardwoods are relatively immune from damage by pests, many of the timbers more recently exploited on a commercial scale, such as obeche from Nigeria and ramin from Sarawak, can only reach the market if protected from damage by ambrosia beetles, powder-post beetles and stain during extraction, seasoning and shipping.

Ambrosia beetles

Ambrosia beetles are interesting insects belonging to the families Scolytidae and Platypodidae. They are small beetles, $\frac{1}{4}$ in. or less in length, and black or dark reddish-brown in colour. They are of varied shape but have in common the fact that they spend most of their cryptic lives in tunnels bored in timber, and feed on a sticky mould or fungus introduced by the adult beetles and growing on the walls of the tunnels. This mould was first noted by Schmidberger in 1836 and christened 'ambrosia'. A great deal remains to be discovered about the habits and life histories of the many species attacking timber. Fortunately, valuable work on the biology and control of ambrosia beetles is being carried out at the moment by Tecwyn Jones, H. Roberts and J. M. Baker of the Colonial Office at the West African Timber Borer Research Unit, under the general direction of Dr. R. C. Fisher.[1, 2, 3]

Ambrosia beetle adults are flying insects, the flight periods in the tropics being mainly in the early morning and late afternoon. Certain species, however, appear during the middle of the day, whereas others fly only by night.

Damage.—The male beetles arrive before the females and select sites for boring. These may be logs with the bark either on or off. On logs with the bark on they frequently select

damaged areas where concentrated penetration may occur. Current investigations appear to indicate that fermentation processes, taking place in the sapwood after felling, produce substances attractive to ambrosia beetles. It has been suggested that these substances may be produced or merely unmasked as a result of the bark being removed or damaged.

Approximately 24 hours after the male beetles have started to bore, the females arrive and flit over the surface of the log searching for bore-dust indicating a tunnel inhabited by an industrious male. The males then emerge, copulation takes place and both return to the tunnel, the female leading. The tunnelling is now continued by the female, whilst the male occupies himself by pushing out the borings which appear on the surface of the log as powder or as cylindrical threads, hanging from the entrance hole (Fig. 1).

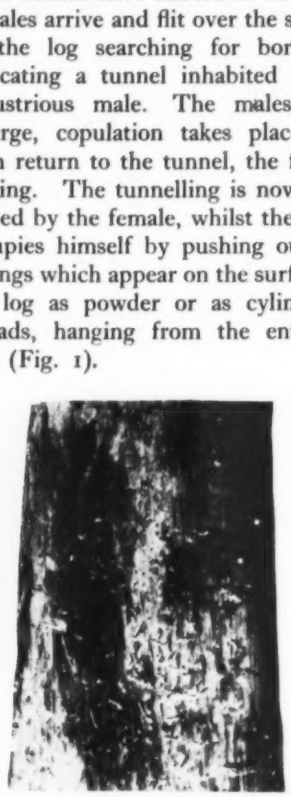


Fig. 1. Extrusions in the form of cylindrical threads made by Ambrosia beetles

The tunnel enters the log in a radial direction but, after penetrating for a greater or lesser degree, turns and is continued in a circumferential direction, with or without branching galleries. The tunnel pattern is to a considerable extent characteristic of the boring species and is usually confined to the sapwood in the case of scolytids, whereas platypodids frequently bore deep into heartwood especially if it is relatively moist.

In all species, however, the tunnels have a circular cross-section produced by the beetles rotating as they cut into the wood, and the inside of the tunnel is usually darkly stained due to growth of the ambrosia fungi. The eggs are laid free in the main tunnel or in niches cut in the top and bottom of the tunnels and when the larvae emerge they feed on the fungus. The larvae pass through an unknown number of instars before pupating. When young adults emerge they remain in the tunnel for some time feeding on the ambrosia fungus before leaving by the original entrance hole either to re-attack the same log, or to fly in search of fresh timber. Depending on species, a pair of ambrosia beetles will produce a family of about 20 to 100 offspring.

From the description given above of the tunnels made by the ambrosia beetles, and from a study of Fig. 2, which shows a small billet cut to demonstrate the nature of the tunnel system, it is obvious that a single tunnel will appear as a pinhole time and time again, when a log is converted to lumber or peeled for veneers. Pinholes cannot be tolerated in decorative veneers and render otherwise suitable wood fit only for use as core stock. Pinholes in lumber are regarded as a standard defect and their presence leads to downgrading. Fungal staining is often associated with pinholes and spreads from the tunnels, sometimes as extensive streaks. This secondary damage is frequently in fact more serious in spoiling the appearance of the timber than the pinholes themselves. Although ambrosia beetles can only live in green timber and die out as the timber is seasoned, this is rarely appreciated by the person buying timber, who regards any hole in wood with ineradicable suspicion. This leads to logs being ' dressed ' in order to present a clean face to buyers, an obviously costly procedure. It is difficult to assess the extent of the loss caused by ambrosia beetles in economic terms but it is certainly considerable. *One interesting estimate, made in the Philippines in* 1929, *was that* 25% *of the* 104 *million board feet of timber exported was graded as wormy, resulting in the loss of* $2,600,000. In West Africa the loss is estimated at 15% of the value of the forest products.

Limitation of ambrosia beetle attack and damage is achieved by well-managed methods of log extraction and by the use of properly formulated insecticides.

Protection.—Logs should be extracted from the forest as quickly as possible and should be kept out of moist, shady situations. Logs which have to be kept in the forest or stored, awaiting conversion or shipping, should be raised off the ground on skids.

The question of whether to remove the bark from logs or not is still to some extent controversial. Logs with the bark on are somewhat less severely attacked by pinhole borers at first than debarked logs, but insecticidal spraying is required as a rule for anything like complete protection and if logs are sprayed with the bark on they may need to be resprayed after the bark has been removed. As the presence of bark may also invite infestation by longhorn beetles, it is advisable to remove bark where possible unless there are sound commercial or economic reasons for not so doing.

A large number of chemicals have been tested as log protectants. Creosote has given reasonable control in some areas but results have been anomalous. The latest results from West Africa indicate that it gives good protection for several weeks and then quite suddenly fails.

Creosote should never be applied to logs with the bark on as it has been shown that it exerts a chemical action on the bark which rapidly releases substances, attractive to ambrosia beetles, and the log then becomes more heavily infested with pinholes than if it had not been treated at all.[4]

The synthetic chlorinated hydrocarbon insecticides developed over the last 18 years have been tested for protection of logs and of them BHC has proved of outstanding value. DDT, Chlordane and Toxaphene have not shown promise but Aldrin and Dieldrin may yet prove useful, although contradictory results have been recorded from the few tests so far carried out with these materials.

In practice BHC has proved most useful and has been tested as a variety

Fig. 2. Tunnels made by Ambrosia beetles

of formulations. The nature of the formulation is most important. Water-dispersible powders give the least satisfactory results as they are readily washed off by rain. To resist washing off by rain, solutions in fuel oil or kerosene have, therefore, been used and more prolonged protection is thereby achieved. The usual practice is to buy a concentrated solution of the insecticide from the manufacturer and then to dilute it on the spot with oil before spraying. Some concentrates, such as ' Protostan ', contain a fungicide, in addition to BHC, and are used to prevent sapstain as well as pinhole damage.

BHC emulsions seem to give results nearly as good as those obtained with oil solutions and definitely better than those with water-dispersible powders.

Oil solutions cannot, however, be applied to logs with the bark on, as fuel oil, kerosene and certain aromatic solvents, used to prepare concentrates, have the same effect on bark as creosote, rendering the log abnormally attractive to ambrosia beetles. Fuel oil itself appears to be attractive to pinhole borers even when sprayed on debarked logs. Other disadvantages of using oil solutions are that oil costs money and it discolours white timber.

Consideration of these factors has lead to the conclusion that for log protection a water-miscible formulation is required which after spraying dries to form a water-resistant film. Such a product known as ' Hexastan LP ' is now commercially available. It contains BHC as the active ingredient and is diluted 1 :9 before use with water. It can be sprayed on logs with the bark on or off, and does not discolour timber.

Insecticides for log protection should be applied as wet drenching sprays and it is most important to wet the log thoroughly all over, and especially to direct spray on to the undersurfaces. If knapsack sprayers are used they should be of the pressure-retaining type; the Ross type sprayer, so widely used in the tropics for applying mosquito larvicides, is unsuitable for spraying logs. Whenever possible a power sprayer should be used.

The application of concentrated sprays to logs using low-volume air assisted sprayers might repay study and, if successful, would reduce the amount of spray to be taken into the forest.

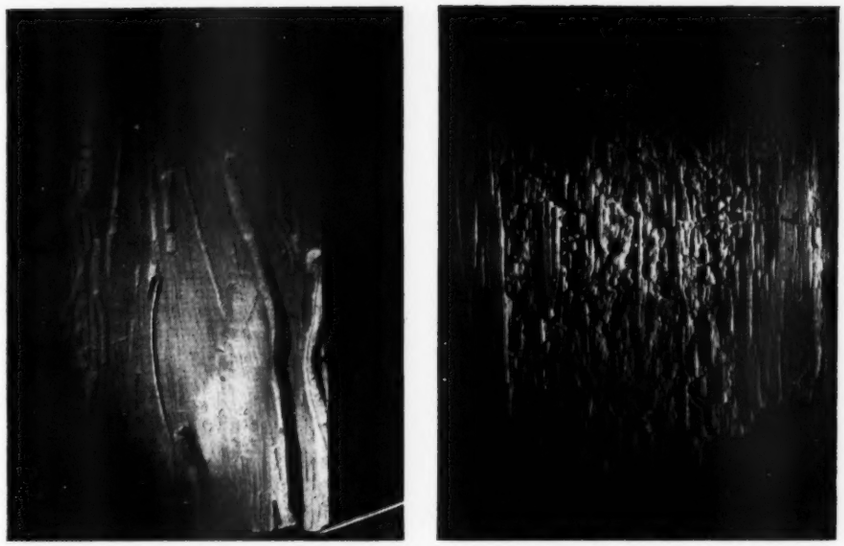


Fig. 3. *Damage done by powder-post beetles.* (Left) *Sawn timber.* (Right) *Plywood*

Powder-post beetles

The term *powder-post* is used to describe various species of wood borers belonging to the families Lyctidae and Bostrychidae. They are serious pests of seasoned and partly seasoned timber. As their name implies, they reduce wood to a fine powder which when rubbed between finger and thumb has a ' floury ' feel.

The Bostrychid beetles are of moderate size, varying from $\frac{1}{8}$ to 1 in. in length. On the average they are larger than Lyctids. They are usually dark-brown to black in colour and have a characteristic circular cross-section and antennae ending in a three-jointed club. Both the beetles and the larvae bore into the timber and the bore dust is packed in the tunnels behind them. The tunnels follow the direction of the grain but may have Y-shaped branches. The eggs are laid by the female inside the tunnel.

The Lyctid beetles are small, reddish-brown to black beetles, more elongated and flattened in shape than the Bostrychids and have antennae ending in a two-jointed club. The adult beetles do not bore into the wood. Eggs are laid in the pores of the wood just below the surface by the female. Within a few days, the young larvae hatch from the eggs and start to burrow into the wood. At first the tunnels follow the direction of the grain but later they may take an irregular course, crossing and re-crossing their own tunnels and those of other larvae. When the larvae are fully grown they move towards the surface of the timber and pupate immediately below the surface. The adult beetle emerges from this pupal chamber and makes its way out of the timber by cutting a small, more or less circular hole. Adults will cut their way, if necessary, when emerging through heartwood, paint, glue and even through lead coverings.

Damage.—Powder-post beetle larvae need starch for their development and for this reason only timbers with starchy sapwood are attacked. This, however, includes a large number of temperate and tropical commercial hard-woods—oak, ash, elm, walnut, obeche (wawa), afara, iroko, ramin, meranti, and kempas to name but a few. Ring-porous woods are much more susceptible to powder-post beetle attack than diffuse-porous ones. Powder-post beetles do not confine their attack to sawn timber but also attack dimension stock, plywood, manufactured articles, floor blocks etc. The actual physical damage caused may be very severe and if unchecked can literally reduce timber to powder (Fig. 3). In addition to direct loss, a firm supplying infested timber can enormously damage its reputation and goodwill. Little in the way of dust is usually seen until exit holes are cut, by which time infestation within the timber will have been active for several months and damage may be considerable. This emphasises the importance of millers and merchants taking routine measures to prevent attack.

Protection.—Lumber (sawn timber) can be effectively protected from attack and damage by powder-post

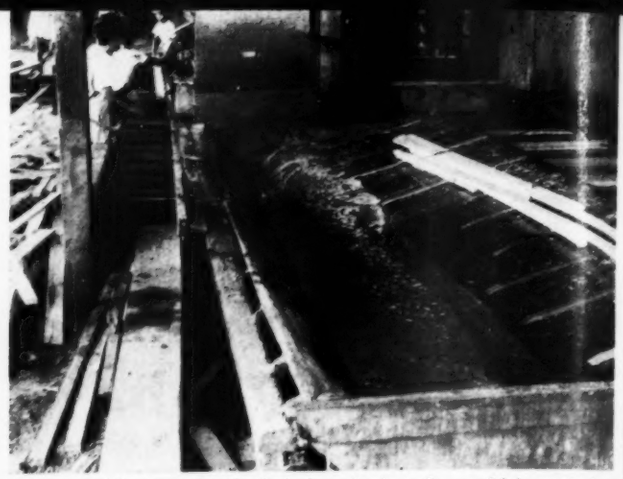


Fig. 4. (left) *A mechanical timber dip in a large African timber and plywood mill*
Fig. 5. (above) *A hand-operated dipping tank in a small timber mill*

beetles by treatment with insecticides. DDT, which was the first of the modern insecticides to become freely available, was found to give satisfactory protection of timber in temperate climates but failed in the tropics except at uneconomically high concentrations. BHC on the other hand has proved over a period of many years to give first class protection both in temperate and tropical climates.

Both wettable powder and special emulsion formulations of BHC are used for treating lumber. Wettable powders, however, have a number of serious disadvantages. Wettable powders must, because of their very nature, settle after mixing with water and, in dipping baths, the powder settles to the bottom where it forms an ineffective and wasteful sludge. In spraying apparatus, too, the powder settles, unless the equipment is provided with an agitator, and trouble may also occur through nozzle blockages, especially if the powder is not mixed with the necessary care. Such sedimentation is increased in the presence of sodium pentachlorophenate, which is frequently used in conjunction with the insecticide to prevent sapstain. Further, wettable powders leave a visible deposit which is definitely unsightly on red woods.

These disadvantages have been overcome in 'Lyxastan', a BHC emulsion especially formulated for the timber trade. It is easily mixed with water and forms a stable emulsion even in the presence of anti-sapstain fungicides. It spreads evenly over the surface of the timber even when rough cut from the saw and also penetrates below the surface, whereas it is impossible for wettable powders so to do. BHC is exceptionally persistent on timber. Oak blocks in laboratory tests have been protected from damage by *Lyctus brunneus* for over two years, whilst in field tests in West Africa, periods of protection of nine months and over have been recorded.

The superiority of emulsions for protecting timber is emphasised by the latest D.S.I.R. Forest Products Research Laboratory publication on spray treatment for prevention of Lyctus attack. BHC is recommended at 0.5% in emulsion form whereas wettable powders at twice this concentration (1%) are suggested as an alternative, if less reliable, formulation.[5]

Dieldrin has shown promise in laboratory tests for protection against Lyctus but has not been used to any extent for protection of green timber in practice. It is more expensive than BHC.

Insecticides are best applied to lumber as it comes off the saw by dipping. In large mills the timber passes through a mechanically operated dip placed at the end of the green chain (Fig. 4). The timber is immersed for a few seconds only, which is sufficient to give it the necessary protective cover. In small mills, simple hand-operated dipping tanks are used (Fig. 5).

A typical dipping mixture used in the tropics for prevention of both powder-post and sapstain damage is as follows:

Santobrite (sodium pentachlorophenate)	15 lb.
Borax	15 lb.
'Lyxastan' (BHC)	5 gal.
Water	95 gal.

Borax is included in the dip as a buffer to prevent the acid sap from the timber reacting chemically with sodium pentachlorophenate to precipitate insoluble pentachlorophenol. Soda ash, sometimes recommended for this purpose, should *not* be used, as it is alkaline enough to give rise to the danger of BHC being decomposed.

When dipping is impractical, timber may be sprayed. It is, however, difficult to obtain complete coverage of timber in stacks by spraying. Whatever apparatus is used it is important that spraying is carried out thoroughly and conscientously. Spray must be carefully directed between boards into the centre of the stack as well as over outer edges and surfaces. Such control measures must be combined with good seasoning yard practice.

Plywood made from powder-post susceptible timbers may be severely attacked. This can be prevented by incorporating BHC or Dieldrin in the glue line, when the glue is of the animal, casein or urea-formaldehyde type. BHC has not proved compatible with phenol-formaldehyde glues.

Powder-post larvae in timber which has already become infested can be killed by fumigation or by kilning. Neither of these treatments, however, protects the timber from subsequent reinfestation and prevention rather than cure is always the wisest policy—and also the cheapest.

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THE TEAK FORESTS OF NORTHERN THAILAND

PROF. DR. ING. FRITZ LOETSCH

(Forestry Expert of FAO, and Chief, Forest Inventory Section, Federal Research Institute, Germany)

An inventory of the forests in five of the northern provinces of Thailand reveals the dangerous position of the teak industry due to the widening gap between the rate of felling and the rate of regeneration. Departures from the Brandis system of restricted felling are the cause.

Although elephants are used for transporting the logs from the mountains down to the rivers, experiments are being made with crawler tractors. The logs are 'rafted' down to Bangkok, a distance of 1,000 km., the overall time taken being between three and five years

THAILAND, like Burma, is world-famous for its teak. The teak areas are located only in the northern provinces north of lat. 16°N., and they cover about 155,000 sq. km., or about one-third of the area of the whole country.

History

In 1893, the Siamese Government engaged the services of Mr. Slade, a British forestry expert from Burma, whose work led to the foundation of the Thai Royal Forestry Department. He introduced the Dietrich-Brandis selection system for the control of timber cutting, a system which had already proved itself in Burma and India.

Under this system the area of each concession is divided into two parts, to be felled in two successive periods of 15 years. Each part is further divided into five blocks. Felling in each block lasts three years and no felling is allowed in the blocks not yet opened for felling. The minimum girth limit for cutting is also fixed by law. With this restricted system of felling there is a felling cycle of 30 years and there would be adequate replacement of the felled trees but for other disturbing factors.

Statistics of the Royal Forestry Department give the average yearly production of teak since 1934, as follows:

1934–38	..	199,000 cu. m.
1939–47	..	84,000 cu. m.
1948–56	..	268,000 cu. m.

As will be seen, production dropped during the war years, due to the reduction in export markets, but since the war, and particularly since 1950, production has far exceeded the pre-war figures.

This increase in production led some Thai economists to assume that teak exports could be increased even more. On the other hand, the Thai Royal Forestry Department was well aware that the teak-bearing capacity of the forests was being seriously reduced by an increase in the amount of illicit felling after the war and by a significant reduction in the teak-bearing area, due to the practice of 'shifting cultivation'. They realised that it was necessary to introduce new and more effective forest legislation, and judged that the best argument to use to convince the Government of the need for this would be provided by a forest inventory. Accordingly the Royal Forestry Department asked FAO if this organisation could send an expert to assist in making an inventory of the forest reserves of Thailand.

Administration

Arrangements were begun in March 1955, when the writer went to Thailand for the first time to work out the procedure to be followed.[1] He returned in July 1956, with the task of making an inventory in the heart of the teak-bearing area of Thailand—the provinces of Lampang, Lampoon, Chiengmai, Chiengrai and Prae. These provinces constitute 39% of the teak-bearing area of the country and cover 61,000 sq. km., but together they yield about 53% of the total yearly out-turn of teak.

The team provided by the Thai Government consisted of 35 Thai forestry officers together with 50 supporting staff. Transport was by cross-country jeeps. Aerial photographs taken in 1953 were available, but these were only on the small scale of 1:50,000. In spite of this, they were useful for determining the extent of various forest types and, in the absence of maps, for finding the location of the areas to be sampled. The 'camp unit system', developed by the writer, was followed and about 100,000 samples were taken, which gave reliable figures for the growing stock of the various types of forest per sq. km. The enormous volume of data, so collected, was enumerated with the aid of Hollerith machines in Bangkok. The maximum allowance of sampling error which it was hoped to keep within was ± 4% for 5,000 sq. km. of teak bearing area and ± 5% for 10

million cu. m. of growing teak stock. In fact, the sampling error for the teak area was as set, while for the growing stock it was considerably less.

Costs

The total costs in making this inventory amounted to some £22,000, of which 90% was for the field work, 6% for the interpretation of the aerial photographs and 4% for the classification by the Hollerith machines. The cost per hectare of forested land, under 1,000 m. above sea level, was about a penny, or under ½d. per acre.[2, 3]

Classification of forests

Table 1 shows the extent of the various types of forest in the five provinces. The most interesting is the mixed deciduous teak-bearing forest (stratum 1), which covers about one-fifth of the whole area, or 10,962 sq. km. Assuming that the five provinces investigated yield about 53% of the total teak out-turn of Thailand, as already stated, the total area of stratum 1 in Thailand can be estimated to be about 20,000 sq. km. The very low figure of 14 sq. km. for teak plantations in Northern Thailand shows that the artificial regeneration of teak is really only beginning. The remaining types of forest in northern Thailand do not contain species of any great importance for export at present.

The semi-evergreen forests (stratum 3) do contain some Dipterocarp species (Yang), but less than is found in the evergreen forests of central and southern Thailand. It is probable that a closer inventory will be conducted in these areas in the near future to obtain figures for Yang and Ta kien,

Table 1
Extent of the different types of forests in the five provinces surveyed in 1956–57

Stratum No.	*Type*	*Below 1,000 m. above m.s.l. sq. km.*	%	*Above 1,000 m. above m.s.l. sq. km.*	%
0	Teak plantation	14	—		
1	Mixed deciduous teak-bearing forest	10,962	20.8		
2	Mixed deciduous forest, without teak	9,629	18.3		
3	Semi-evergreen forest	5,794	10.1		
4	Hill evergreen forest	155	0.3	2,877	34.9
5	Coniferous forest	493	0.9		
6	High open Dipterocarp forest	973	1.8		
7	Dry Dipterocarp forest	12,772	24.2		
8	Savannah forest (the soil covered by Imperata grass)			1,951	23.6
9	Clearings, now abandoned	3,009	5.7	2,460	29.8
10	Clearings, now under cultivation	1,839	3.5	962	11.7
11	Permanent agricultural land	5,184	9.8		
12	Unforested	1,936	3.7		
		52,760	100%	8,250	100%
	Forested areas or covered by shrubs	43,801	83%		

Hopea odorata, the next most important species after teak.

Stratum 7 (dry Dipterocarp forests on lateritic soils) occupies nearly one-quarter of the whole area (12,722 sq. km.). This type of forest is an important source of fuel, since there is no coal in Thailand, and provides firewood and charcoal. About one million cu. m. of wood are consumed every year by the railways alone.

Shifting cultivation

Stratum 10 consists of burnt forest areas which are at present under cultivation and stratum 9 includes areas which were burnt and cultivated and are now abandoned. The total area under shifting cultivation is thus about 5,000 sq. km. (strata 9 and 10). This is about 25% of the total area of strata 1 and 2, the mixed deciduous forest into which the local inhabitants encroach for this wasteful type of cultivation. *This high percentage is an indication of the danger which threatens the Thai teak industry due to the practice of shifting cultivation.*

Table 2
The total stock of all species in the five provinces

Species	*Cu. m. (Hoppus) in millions of trees over 30 cm. d.b.h.*	%	*Yearly outturn in millions cu. m.*			*Total outturn in % of the total stock*
			legal	*illicit*	*total*	
Tectona grandis (teak)	9.22	9.0	0.22	0.33	0.55	6.0
Dipterocarpus alatus (Yang)	2.63	2.6				
Pterocarpus macrocarpus (Pradu)	3.77	3.7				
Hopea odorata (Ta kien)	2.67	2.6				
Other species with cut limit from 200–250 cm. in girth*	6.15	6.0	0.28		(0.4)†	0.4
Other species with cut limit from 100–150 cm. in girth	54.76	53.3				
Species of no commercial value (mostly soft woods)	23.40	22.8				
	102.60	100				

* Girth limit 200 cm. means that there is a law forbidding the cutting of trees of smaller diameter
† Estimated

A mixed deciduous teak-bearing forest in Thailand. The tree prominent in the foreground is teak; the undergrowth here consists mostly of bamboo. In these forests teak represents only 9% of the total of all species

The mountainous area over 1,000 m. above sea level, the figures for which are given in the right-hand column of Table 1, is occupied by nomadic hill tribes which have immigrated from the Shan States and from China. These people also practise shifting cultivation and have so far wrested from the forests nearly one-half of the total area above this height. This may have a serious effect on the watershed regulation of Thailand.

Felling v. regeneration

Table 2, which analyses the growing stock in the five provinces investigated, shows that teak represents only 9% of the total for all species. The amount of teak with a girth of 30 cm. d.b.h.* and over, is 9.2 million cu. m. (Hoppus). For the whole country, therefore, the stock of teak can be roughly estimated to be about 17 million cu. m.

The right-hand column of Table 2 shows the yearly out-turn of teak in the five provinces. Legal felling by the teak companies amounts to 0.22 million cu. m. a year, and illicit felling which it has not been possible to control, is as much as 0.33 million cu. m. a year. The estimates for the amounts of legal and of illicit felling were obtained by measuring the teak stumps found inside the sample plots. A stump of a legally-cut tree bears an official hammermark, which is not present on the stumps of illegally-cut trees. The figures obtained by the ratio of girth at stump height to girth at breast height can be converted to equivalent mass volume.

It will be seen further that the species most sought after is teak—the yearly out-turn, both legal and illicit, being 6% of the available stock, the out-turn of other species for all purposes, including firewood and charcoal, being no more than 0.6% of the total stock. This table also indicates the second big threat to the Thai teak industry—the fact that *the illicit out-turn is 150% of the legal out-turn.*

Teak is the predominant species found in the mixed deciduous teak-bearing type of forest (stratum No. 1), but in comparison with the total stock of all species of trees of more than 30 cm. d.b.h., the volume of teak does not reach even one-third of the total volume (Table 3). When it comes to the big trees which have the girth limit for cutting fixed by law—which for teak is 68 cm. d.b.h.—the percentage of teak as compared with other species decreases to 12%. This bears out the observation that of all the large trees in Thailand it is only teak that is used; large trees of other species are left in the forest.

Teak has a natural tendency to regenerate itself. Thus the fact that teak is the only species being cut for timber does not, as is sometimes thought, mean that there is a danger of it being gradually eliminated and displaced. The use of the Brandis selection system ensures that there will be sufficient replacement of the felled trees. The proportion of young teak trees would be even larger, if so many teak seedlings were not destroyed each year by forest fires.

A comparison of the stock of teak in Thailand at various periods is given in the diagram. The estimate of the original stock was reconstructed from what remains of the virgin teak-bearing mixed deciduous forest. The figures for the stock in 1937 are taken from the results of a Thai survey which counted the trees before the last exploitation within a period from 1919 to 1954. The estimated stock in 1957 had there been no illicit cutting was obtained by adding the illicit out-turn, including the lost growth, to the inventory results of 1957.

The original stock must have been very rich in large over-matured trees and consequently rather poor in undersized trees. The 1937 column already shows a remarkable decrease in the large trees and an increase in the

* d.b.h. = diameter at breast height

A young (10-year-old) teak plantation. The presence of ' lalang ' or ' illuk ', Imperata cylindrica, *shows that this was once an abandoned clearing, which is now being reafforested*

Table 3
The stock in the teak-bearing mixed deciduous forests of Thailand (Stratum No. 1) per sq. km.

Species	*Trees more than 30 cm. d.b.h.*			*Trees more than girth limit**		
	No. of trees per sq. km.	*Hoppus volume per sq. km.*	%	*No. of trees per sq. km.*	*Hoppus volume per sq. km.*	%
Tectona grandis (teak)	1,078	907	29.2	70	219	11.9
Pterocarpus macrocarpus	138	232	7.5	47	156	8.5
Other species with girth limit 200–250 cm.	23	42	1.4	9	30	1.6
Xylia kerrii	287	314	10.1	219	291	15.8
Terminalia mucronata and tomentosa ..	334	303	9.8	235	268	14.6
Lagerstroemia calyculata	113	123	4.0	91	115	6.3
Other species with girth limit 150 cm. ..	329	329	10.6	236	294	16.0
Species with girth limit 100 cm., *Pentacme siamensis predominating*	475	465	15.0	475	465	25.3
Soft woods of no commercial value ..	497	386	12.4	—	—	—
	3,274	3,101	100	1,382	1,838	100

* Explanation see Table No 2

undersized trees. It is interesting to compare this with the estimate of what would have been the stock in 1957, if there had been no illicit cutting. The total stock would have been greater than the total for 1937 but the decrease in the large trees would have continued. The greater part of the stock would have been trees of a younger generation, having a girth of under 68 cm. d.b.h.

This demonstrates the natural capacity of teak for regeneration. The Brandis selection system would have worked well; the rate of re-growth would have been increased by regenerating the stock and a sustained yield, of the same amount as before, would have been assured, provided the girth limit for cutting was lowered to about 60 cm. d.b.h.

Unfortunately this sound and economical policy has been upset by the amount of illicit felling, particularly since the war. Most of this is confined to undersized trees of from 40 to 60 cm. d.b.h. For this reason the stock of undersized trees, as well as of the trees beyond the girth limit, has been reduced to the extent shown in the diagram. *It is clear from this that the depleted stock cannot continue to yield at the present rate of yearly out-turn, and will not be able to do so for a long time.*

The future

The annual current growth of trees of 30 cm. d.b.h., and over, amounts to 49% of the total out-turn. Taking into consideration only trees of 50 cm. d.b.h., and over, the percentage drops to 18% which means that the present total annual out-turn of teak is about five times higher than the rate of growth of trees of this size. It can be assumed that trees between 30 and 50 cm. d.b.h. grow about 4.5 cm. in ten years. Therefore for the next two decades they cannot be taken into consideration for any legal use, even if the girth limit for cutting were to be lowered to 60 cm. d.b.h. It can easily be calculated that *the stock of teak trees of 50 cm. d.b.h., and over, will be reduced to zero within 15 years unless the Thai Government can control the illicit cutting of teak and also, no less important, the losses through 'shifting cultivation'.*

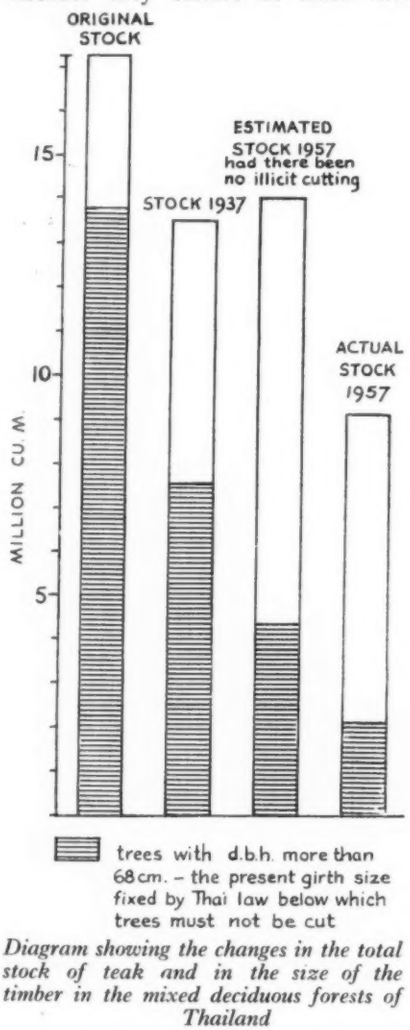
ORIGINAL STOCK
ESTIMATED STOCK 1957 had there been no illicit cutting
STOCK 1937
ACTUAL STOCK 1957
MILLION CU. M.
15
10
5
trees with d.b.h. more than 68 cm. – the present girth size fixed by Thai law below which trees must not be cut

Diagram showing the changes in the total stock of teak and in the size of the timber in the mixed deciduous forests of Thailand

It is safe to conclude that the present trend in the market will continue—Thailand will reduce her exports of teak considerably and Burma will regain her leading position as an exporter.

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Union of South Africa

New forestry schemes are under way to make the Union of South Africa 95% self-sufficient in timber by A.D. 2000. Natal, and particularly Zululand, will be the main suppliers and two major planting schemes are already in operation. It is estimated that there will be 1,350,000 acres under trees in the area when these two projects are completed. The first scheme will cover 580,000 acres and will cost about £32 million over 40 years. The second undertaking covers the area from Richards Bay to St. Lucia Bay. It has been in progress for some time, but about 165,000 acres still have to be planted.

The total of all afforestation schemes completed or under way amounts to some $2\frac{3}{4}$ million acres, of which the State will own about half.

AFFORESTATION OF THE SWAMPLANDS OF FINLAND

OLAVI HUIKARI
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The production and processing of timber for export is an industry of great economic importance to Finland. Indeed, forest products constitute about 80% of the value of her exports. It is natural, therefore, that she should explore the possibilities of extending her forest areas by reclaiming the swamps.

THE Third National Forestry Inventory of Finland carried out in the years 1951–53 showed that swamps cover 31.9% of the total land area of Finland, equivalent to 9.7 million ha.

Because of this abundance of swampland, investigations into its possible use for forestry has been given high priority. In the course of these investigations such aspects as hydrology, nutrient status of the soil, microclimate, suitability of different tree species to the various soil types, and thinning methods for the growing stock have been considered.

The investigations have shown that swamps which in their natural condition are poorly productive can be transformed into highly productive forests simply by drainage. It was also apparent that the nature of these swamps is the best indication of their potential productive capacity.

Ecological survey

When classifying such swamps for afforestation they are divided into three main categories according to the existing plant cover, *i.e.* spruce-growing, birch-growing and unsuitable areas.

If the lesser vegetation includes eutrophic *Bryales* species in moderate abundance, the soil is particularly rich in nutrients; if these are not found, but herbs are present in moderate abundance, the swamp is poorer in nutrients; if neither is present, but sedges, *Carx* spp., are plentiful, the site is regarded as moderately rich in nutrients. If the lesser vegetation does not include any of the plant groups previously mentioned, but is dominated by *Eriophorum vaginatum*, *Scirpus caespitosus* or so-called big twigs (*Ledum*, *Vaccinium uliginosum*, *Calluna* etc.), the site is poor in nutrients and, accordingly, only in the warmer regions in the south is it worth introducing drainage. The sites poorest in nutrients present a lesser vegetation dominated by *Sphagnum fuscum*.

Application of fertilisers

Swamps dominated by sedges, herbs and eutrophic Bryales can be transformed merely by drainage into good forest land; but swamps with poorer soils require the application of fertilisers in addition. Frequently there is a deficiency of available phosphorus and, on swamps with deep peat, even of potassium. The experiments with fertilisers indicate that the phosphorus deficiency can be corrected in most cases by applying about 500 kg./ha. of phosphorus fertiliser (27% of P_2O_5) and that of potassium, which is less common, by about 300 kg./ha. of potassium fertiliser (40% of K_2O). This treatment need not be repeated for at least 20 years, since nutrients are returned to the soil with the annual fall of pine needles.

Table 1 shows the growth capacity of certain swamp types, without fertilisation, in five climatic regions. The figures are based on regular successive measurements of permanent sample plots maintained by the Department of Swamps at the Forest Research Institute of Finland. There are some 600 such sample plots in the drained areas in different parts of Finland.

A former treeless eutrophic swamp, which was drained in 1950. By 1955 it had become mixed birch-pine forest, as seen here

State aid

Systematic swamp drainage for the purpose of afforestation started in 1909, when specially trained men were employed by the Forest Service to plan and supervise the work in the State-owned swamps. Similar activities in privately-owned swamps were also assisted by the Government under the Forest Improvement Act of 1928. Up to 1953 this Act provided the necessary funds for both the State-owned and the private forests, but the Forest Improvement Act of that year was restricted to private forests and for the five-year period 1953–57 the minimum annual appropriation for forest improvement has been set at 600 million Finnish marks, most of which will be spent on drainage. For the State-owned swamps drainage work is now included in the budget of the Forest Service.

Government aid has been motivated by the immense national importance of this work as well as by the fact that private landowners cannot afford to spend money on such basic long-term improvements.

So far 850,000 ha. of swamps have been drained for afforestation in Finland, and about 150,000 km. of ditches have been dug. The ditches are, on

A trench made in a swamp of deep peat by a Lokomo plough

average, 70 cm. deep and their volume averages about 0.5 cu. m. per m. in length. Depending on the gradient and the swamp type, the distance between ditches varies from 50–80 m. On the better soils and more sloping land the distance between ditches is greater than on a poor and more level terrain.

Labour problem

Until the second world war the principal tool used for digging these forest ditches was the spade. The difficult labour situation following the war, however, greatly accelerated the application of more up - to - date methods.

In the years 1949–52 dynamite found large-scale application in stony swamps, with a considerable saving in labour. Since many of the areas to be drained were stony, shallow-peat with an abundance of stumps, horse-drawn ploughs were not suitable for such heavy work.

A forest plough

In 1951 experiments were started for the construction of a plough which would be better suited to this work. The principal object has been to design, on theoretical and practical considerations, a forest plough which will operate in any circumstances likely to be met in forest terrains with trees, stumps or stones.

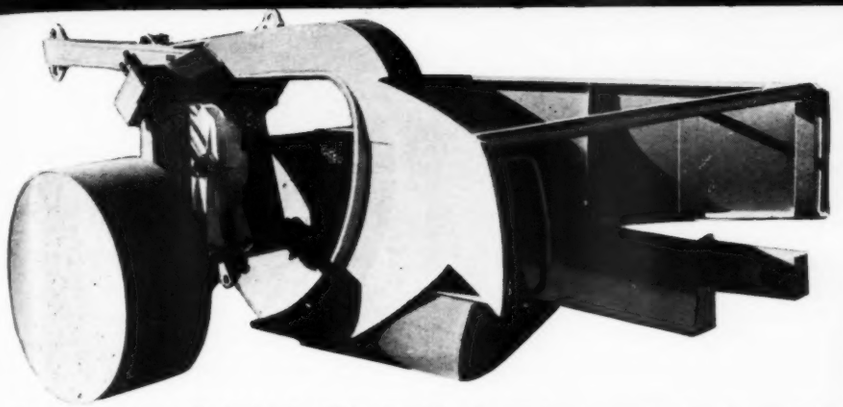
The first experimental plough was an American vineyard plough. Subsequently, several different experimental ploughs were tested. Finally, in 1954 trials had proceeded so far that commercial production of a forest drainage plough could begin.

Most of the 70–80 ploughs now in use have been constructed and manufactured by Lokomo Oy. The new plough weighs 8,500 lb. and is heavily constructed so as to be able to work under the most severe conditions. The plough point is made of heavy-duty,

Table 1
Sample Plot Measurements

Climatic region	*At the moment of drainage*		*Year of drainage*	*Cubic volume (including bark)*			*Growth (excluding bark)*		*Year of last measurement*
	*Quality of the swamp**	*Peat layer, m.*		*At moment of drainage*	*At last measurement*	*Amount thinned*	*At moment of drainage*	*At last measurement*	
				cu. m per ha.	*Solid measure*	*Solid measure*	*cu. m. per ha.*	*Solid measure*	
1	e	1.5	1925	(6)	200	1	(0.1)	10.1	1951
1	m–e	1.2	1929	9	135	4	(0.6)	9.0	,,
1	o	0.5	,,	(3)	93	8	(0.3)	6.2	,,
2	e	0.5	1914	(2)	166	(51)	(0.1)	9.0	1952
2	m–e	5.2	1907	(4)	132	(19)	(0.2)	8.2	,,
2	o	2.5	1905	(60)	136	(7)	(0.5)	2.6	1948
2	e	1.3	1911	6	221	108	0.8	8.8	1953
2	m–e	0.8	1930	3	83	25	0.1	6.8	,,
2	m–e	0.4	1909	3	141	17	0.3	6.2	,,
2	m–e	0.8	,,	△	142	23	—	3.9	,,
3	e	1.2	1932	5	104	9	0.1	5.4	1955
3	o	0.6	,,	30	95	10	0.5	3.6	,,
3	e	0.5	1934	5	84	18	0.2	5.2	,,
3	o	0.1	1933	47	114	16	1.7	4.7	,,
4	m–e	0.2	1932	76	124	35	1.2	4.2	1954
4	e	0.5	1933	21	41	16	0.4	2.1	,,
4	e	0.5	,,	42	40	22	0.4	1.2	,,
5	e	0.2	,,	38	64	6	0.8	1.8	1951
5	m–e	0.6	1932	71	71	34	1.2	1.6	,,
5	e	2.2	,,	18	50	5	0.5	1.7	,,

*e = eutrophic; m-e = meso-eutrophic; o = oligotrophic.



The Lokomo forest ditch plough. This plough is of extra heavy construction for work in very severe conditions. The plough point, which can be seen between the wheels, is adjustable so that it can cut either deep or shallow ditches

specially resistant steel and the wing edges are hard-welded. A coulter disk is mounted between the wheels and held in the cutting position by the pull of the tractor. The coulter disk is so mounted that it can rise and ride over rocks and other immovable objects.

These new forest ploughs have completely revolutionised the technique of forest drainage. The rapid increase in their use is brought out in Table 2, which gives the work done by forest ploughs in successive years since 1951.

Table 2
Progress of Drainage Works

Year	*Length of forest ditches*
1951 ..	8 km.
1952 ..	9 km.
1953 ..	160 km.
1954 ..	1,500 km.
1955 ..	3,300 km.
1956 ..	7,300 km.

The ditches are perfect and are cut at only a quarter of the cost of using spade and dynamite. On this basis it can be calculated that about 800 million marks were saved in 1956 by the use of these new forest ploughs. The reduction in operating cost will effect a further saving of at least 100 milliard marks in the draining of swamps which has still to be tackled.

Ploughing operation

Before marking ditches the work has to be carefully planned so as to create a drainage area which will be as extensive as possible. Poorly productive areas, hampered by abundant water, need a preliminary investigation to ascertain the quality of the soil, the thickness of peat layer and the gradient. On the basis of this information, the drainage system can be planned and marked out with poles.

The ploughing equipment consists of a crawler tractor of 10–20 tons with special extra broad tracks and the forest digging plough. Allis-Chalmers crawler tractors and Caterpillars have both been found suitable for this work. A working group consists of a foreman, a tractor operator and two plough attendants, as well as three to five men for cleaning up the ditch.

The tractor pulls the plough through the soil by means of a winch and steel rope, using the full length of the rope; it then moves on to a new position along the ditch line. The rough channel thus opened up is cleared to allow the free flow of water, by means of a light excavator or by spade.

The winching method has proved far superior to the normal straight draught wherever there is deep peat (over 0.5 m.), but it is essential that the track shoes should be broad enough to ensure that the surface pressure does not exceed 350 g. per sq. cm. of track in contact with the surface. If this requirement is fulfilled, the pulling machine can operate on any swamp having a solid surface of regular ground vegetation. Where there is much water, tree stems are set crosswise to anchor the pulling machine more firmly. In the event of the machine becoming submerged in the swamp, it can usually be pulled up with the aid of the winch, with the plough now serving as the anchor, and by binding big poles to the tracks so that the tractor is able to reach the firmer ground.

The output of ditch varied in the various operational areas in 1956, according to conditions, from 150 to 725 m. per hour, the average for the whole country being 300 m. per hour.

Covered ditches

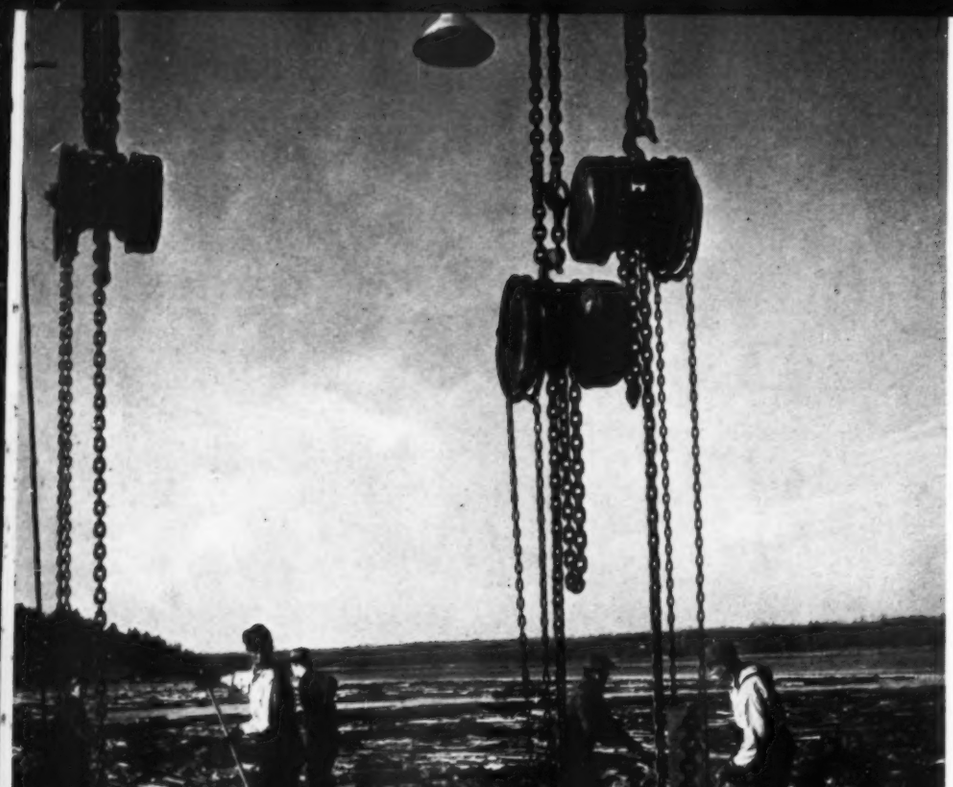
In recent years covered ditches have been used for drainage operations in addition to these open ditches. An open ditch, about 70–90 cm. deep and about 30 cm. broad with vertical sides, is first dug. At the bottom of this ditch a layer of branches and poles, about 40 cm. thick, is accumulated. On top of this a 10–20 cm. layer of raw sphagnum or tough turf is placed and this is covered by the soil removed during digging. A special plough is under trial for covered-ditch drainage with the aid of which the ditch can be opened up with only one pull. Investigations have revealed that covered ditches filled with poles will function for 40 years on peatlands and for at least 25 years in non-peaty soils.

A Lokomo forest ditch plough being drawn by hawser and winch operated by an Allis Chalmers HD-11 tractor. The wooden baulks are for brushing aside the spoil brought up by the plough

Looking ahead

The National Forest Inventories have proved that there are in the whole country some four million ha. of virgin swamp worth draining.

Where the site is sufficiently rich in nutrients and drainage has been properly carried out, the swamps in Finland are easily regenerated by self-planting; where it is necessary to improve the nutrient status, this can be done by applying fertilisers. In this way it is possible for swamps, now almost unproductive, to become forest areas of high productivity. It is calculated that the annual growth capacity of Finnish forests can thus be increased by about 12 million cu. m.



Logging scene in Manitoba, Canada

Canadian Poplar for Paper and Plywood

LITTLE used up to now, poplar is one of the most common tree species in the prairie provinces of Canada and a study was recently made by Arthur D. Little Inc., U.S. industrial research consultants, for the Manitoba Department of Industry and Commerce into the possible utilisation of the province's large stands of this species. A 116-page report was drawn up which envisages the use of poplar for timber and plywood, in addition to its use for the manufacture of newsprint, corrugated board, hardboard and insulating board.

The industrial organisation proposed in the report consists of a large core industry, such as a newsprint mill or a building-board mill, with satellite industries, such as plants for making plywood and lumber out of the better grade woods grouped nearby. The total industrial potential is estimated at U.S. $38 million.

According to most recent forest surveys, there are 20 million cords* of accessible hardwood on Crown lands in Manitoba, plus about 470,000 cords on private or settler land. Of this, it is estimated that 90% is poplar, mostly aspen—the rest being black poplar. Non-inventoried agricultural land contains an estimated one million cords of poplar, thus making a total potential of 1½ million cords.

In Canada poplar lumber is used in construction bracing and studding, and where it is not exposed to much moisture. Due to small log size, low compression strength and the occurrence of knots, poplar is not generally converted into heavier construction material, such as timbers and beams.

Several new mills have recently started production of poplar plywood in the prairie provinces, the two such mills in Manitoba producing an estimated 7½ million sq. ft. of ¼-in. plywood a year. This is used chiefly in construction work as concrete forms, sheathing, partitions and floor underlay. Poplar plywood is not considered ideal for concrete framework because of its low moisture and decay resistance, but its low price and ready availability more than outweigh the negative factors.

JOHN GRINDROD

* Cord=Pile, approx. 8ft. × 4ft.

Italy

Poplar plantations are also found extensively in the plains of northern Italy and cover an area of 34,320 ha. Among the products of poplar growing, paper is the most important, with 503 cellulose factories and an output of roughly 915,000 tons of paper and cardboard, enough to satisfy the demand of the entire home market and leave a good margin for export

THE QUALITY OF TEA

Part II—Preparation in the major producing areas

C. R. HARLER, PH.D.

In Part I of this article, published in our December issue, Dr. Harler gave a detailed classification of the various varieties, sub-varieties, jats, agrotypes and clones; he described the method of processing and listed the factors of quality in tea. Here, various methods of preparation of tea are compared, the effect of climatic differences is discussed, and the importance of clonal planting is indicated.

CHINA is the classic tea country and tea, either as a medicine or a beverage, has been known there for perhaps 2,000 years. Black tea has been prepared in China for over 1,200 years.

The preparation of tea is a family affair. When the flush is ready the farmer, his relatives and friends pluck it early in the day when the dew is off the leaf. The harvest is spread in the sun for an hour or two to wither and is then put on a table, where it is tossed and turned and manipulated in the hands till it is sufficiently bruised to start fermentation. The damaged leaf is then put in a cool place till the aroma develops, after which it is thrown into an iron pan heated to redness over a wood fire. The leaves crackle and steam and give off a vegetable odour which soon subsides, and the tea fragrance returns.

The leaf is then rolled and panned in a hot pan alternately several times, the latter process gradually driving off moisture. When the leaf is too crisp for further handling it is dried slowly on a bamboo tray for maybe 18 hours over a small charcoal fire.

The period of the wither here is short and does not allow the full development of quality as understood in India and Ceylon.

It may be assumed that during the first hot panning the oxidising enzyme in the leaf, responsible for initiating fermentation, is destroyed and that no further appreciable oxidation of polyphenols takes place. During the subsequent rollings and pannings the oxidised polyphenols will continue to polymerise for some time, much as leaf in a modern tea drier tends to 'stew' on the upper trays before it reaches a certain degree of dryness.

China teas owe their particular character to the extreme type of China variety grown and to the method of preparation. The latter tends to leave quality undeveloped or to mask it and to cause the liquor to lose brightness. If the leaf were manufactured as in India or Ceylon, by machinery, a brighter, brisker liquor with quality should result. Indeed, black teas made in this manner from China bushes in Japan and Formosa resemble Assam teas, but they also have the China tang or herbal flavour.

Recently very fine spring teas have been made in Yun-nan, resembling early Assam teas, and it is possible that a manufacturing process similar to that in Assam may have been followed, probably with the big-leaved China plant, indigenous to western China. Teas similarly bright have also been produced recently in eastern China.

The growth of the tea bush in China, as in North-East India, is seasonal and flushing practically ceases in the cold weather. The spring teas in China have flavour and these early pickings may constitute half the meagre crop obtained in this country, for the bushes are stripped of leaf in the early part of the year. In Assam much bigger crops are made than in China, partly because the first flush, in the spring, is left to grow about 6 in. before it is tipped. These tippings make only fair teas, and by far the best invoices of the season are made in May and June, when the second flush is harvested.

It is possible that if the village tea industry in China employed improved field methods and followed modern methods of manufacture the out-turn might well compete with plantation-produced tea.

Assam

About the year 1834, when the East India Company decided to plant tea in India, seed was imported from China and planted in Assam. However, in many places in the Assam valley, wild tea of the large-leaved types was found, no doubt the remains of previous village cultivation. These plants were plucked and the leaf prepared in the China manner by Chinese brought into the country for that purpose. In 1838 sufficient tea was thus made to constitute an invoice which was sold at the London public auctions on 19 January, 1839. The character of the liquors was at that time acknowledged to be different from that of true China tea.

Very soon the Assam planters began to modify the China way of preparing the leaf, for the methods followed by the smallholder in the village were not suited to production on plantation scale. The short two-hour wither in the sun was replaced by an overnight, 18-hour wither on bamboo trays or racks. By 1870 the hot panning process was being abolished and the withered leaf was just hand-rolled and then left to ferment on a cement floor for an hour or two. Drying was completed in one operation, lasting about 45 minutes, in a kind of chest of drawers with four or five movable trays. Heat was supplied by the fumes of a charcoal fire below the bottom tray.

In 1870, the first tea roller was introduced, and 10 years later driers, resembling in principle our modern machines, were in use. By 1890, most estates were equipped with machinery closely resembling that employed today and the tea house became the tea factory.

Each change in procedure produced a slightly different tea, because it in-

Old and new methods of rolling tea leaf

(Above) *Indians rolling with the hands and feet in the early days in Assam*

(Right) *A modern rolling machine in action*

volved some alteration in conditions of time, temperature or concentration of leaf juices. Most of the changes at the time they were made were looked upon with disfavour by the buyers and, indeed, were resisted by many planters.

Over the years a standard procedure of manufacture has been evolved, based partly on convenience in dealing with the crop, but mainly on the reports of tea tasters. Such procedure is followed, with modifications to meet local conditions, throughout the plantation industry in India, Ceylon, Indonesia and East Africa.

But other changes, besides those in manufacture, have also taken place in North-East India. Over the past 50 years practically all the China and China-hybrid bushes have been replaced by large-leaved plants of the Assam and Burma sub-varieties. As the result of changes in procedure and type of plant, a very different tea from the original China commodity has been gradually evolved.

As stated earlier, the Lushai, Cambodian and China-hybrid sub-varieties are not favoured in North-East India. A few years ago miniature manufacture of leaf from bushes of these three types was carried out and the teas thus produced compared with ones similarly made from Assam- and Burma-type bushes. The results of the experiment confirmed the opinion of planters based on years of observation and experience. Details are given below.

In this experiment Lushai leaf gave strong teas, but coarse in character and poor in quality, valued at about 2*s.* 9*d.* per lb. The Assam and Burma leaf gave almost as good strength as the Lushai, but also good quality, with valuations about 3*s.* 1*d.* per lb. The China-hybrid leaf always gave teas with a China tang, inferior in liquors to the Assam and Burma, with valuations about 2*s.* 10*d.* The Cambodian leaf scored low marks in all liquoring respects and averaged only about 2*s.* 5*d.* per lb.

Yet, in spite of standardisation of factory procedure and of bush variety in North-East India, there still remains much to be done in the production of quality teas because of the inherent differences between bushes belonging to the same *jat*. It is possible to select individual bushes from an agrotype, which give tea valued up to 1*s.* per lb. higher than the average. Such bushes have pubescent (hairy) leaves on the flush, and when they are vegetatively propagated from leaf cuttings the progeny have the same stand-out qualities as the parent.

Darjeeling

Tea in the Darjeeling area is planted at an average height of 3,500 ft., with the highest at about 6,000 ft. The other tea districts of North-East India are generally at altitudes ranging from 300 to 500 ft. above sea level. The method of manufacture followed in Darjeeling resembles that in Assam, although natural withering is often difficult and warm-air lofts are used.

The tea in Darjeeling is a China-hybrid, and it has been suggested by some botanists that it is a cross between the true tea species and some plant outside the species. Be that as it may, the plant grown in the area produces a unique tea. The second flush teas, made in May and June, are perhaps as highly valued as any in the world for flavour and character, although teas of the preceding and following flushes sometimes fetch no better prices than Assam plains teas. During the flavoury period the leaf juices are particularly sticky because of the gummy matter therein and this apparently 'takes the fire' well. Accordingly, drier temperatures as high as 240°F are commonly employed to develop this characteristic.

When the Assam type of bush is grown in Darjeeling it fails to produce the typical tea of the district. One estate with a considerable area of such bushes actually manufactures the leaf separately and markets the tea under a separate name, so different is the product from that yielded by hybrid bushes.

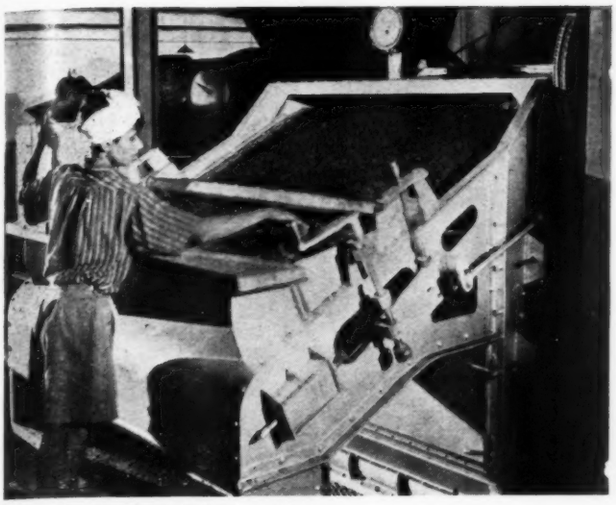
When hybrid plants from Darjeeling are put out in Assam the teas made therefrom lack both the Assam quality and also the Darjeeling characteristics to any worth-while degree. The liquors are poor, with a China character.

Ceylon

In Ceylon the seasonal differences in temperature are insufficient to cause the bush to stop flushing in the cool or drier period and the crop is gathered all the year round, albeit at a varying rate. The best quality teas are made during the slower growing period, in the drier season and from the spring flush.

Old and new methods of drying tea

[The old prints are reproduced by courtesy of Davidson & Co. Ltd., Belfast; the photos of modern machinery by courtesy of the Tea Bureau, London.]



(Above) *A modern firing machine*

(Right) *Leaf being dried on bamboo trays on the top of waisted baskets which have a small charcoal fire at the foot*

The finest Ceylon teas are the high-grown, which have distinctive flavour and quality. The low-grown teas lack these assets, but are valued for their appearance and make. Although climate and careful manufacture contribute to the characteristics of Ceylon teas in various areas and at different altitudes, it is the China-hybrid plant in the up-country districts which is the overwhelming factor in producing the teas for which Ceylon is renowned. In the same way the so-called high *jat* tea plants, with large leaves, in the lower elevations are responsible for the characteristics of the out-turn in these areas.

Assam and Burma types, with large, juicy leaves, when grown at high altitudes, may produce teas with the characteristics of the low country, well-twisted leaf and strong, coloury liquors, although manufacture has followed the same procedure as with hybrid leaf producing all the properties of high-grown tea. Similarly, types suited to the high-grown areas do not produce good teas in the low country.

It is considered to be fortunate that, in Ceylon, most of the high-*jat* tea is at the lower elevations and the China-hybrid strains have been planted in the up-country areas.

Much of the stand in Ceylon is near the age for replanting and the opportunity will be taken for using selected clones, many of which are available, giving high yields of quality tea and showing resistance to disease. In the high-grown areas many of the clones selected are plants with big leaves.

South India, Java and Kenya

Ceylon is the geographical extension of South India and the teas from the two areas might be expected to be closely related. Nevertheless, although some high-grown estates in South India produce very fine teas, others fail to reach Ceylon standards. This may be in part due to the climate, which is not generally as favourable as in Ceylon, but it is also because many up-country areas are planted with bushes of the large-leaved varieties.

In both Java and Kenya the Burma and Assam large-leaved types are also used. Although some Java teas are fine and the Kenya teas have of late been steadily improving, in neither area do they compare with the best Ceylon marks, nor are they of the same quality as the best Assam teas. The climates of both Java and Kenya are so equable, with sufficient rainfall in most months and an even annual temperature, that there is little seasonal change in the rate of growth, and in each month a regular 7 to 9% of the annual out-turn is harvested. Nothing comparable to the spring flush nor to the autumnal teas of North-East India is produced in Java or in Kenya.

Selection, quality and the future

It is thus possible to account generally for the outstanding flavour or quality, or lack of these attributes, in the teas from any area by reference to the climate and to the variety of bush grown, assuming that the plucking is reasonably fine and the manufacture carried out with due care.

Yet there are many cases of two adjacent estates, equally well managed and equipped, both having stands of apparently similar *jats* of tea, where one produces quality teas with no apparent effort, whilst the other, with all care and attention, cannot do so. This is due to inherent differences between the bushes which make up the two stands.

Two plants of the same *jat* or the same agrotype may differ greatly not only in cropping capacity, but also in the quality of the out-turn. From an area of 40,000 bushes, chosen because of its goodness and evenness, perhaps one to five plants may be high yielders of tea distinctly above the average quality. One of these five may give tea of outstanding quality.

It is the immediate task of the industry to select high-yielding, quality clones, which will be propagated either vegetatively or by clonal seed, if the latter is practicable.

The yield of tea in Assam 30 years ago averaged 500 lb. per acre. Today the average is over 900 lb., whilst some estates make over 1,500 lb. of fine tea per acre. These increases have been made possible largely by improved field methods. Another factor has been the steady replacement of old tea by a better stand. The use of selected clonal is only just beginning and as yet has had no effect upon either average yield or quality.

If clonal material is used from now on, within 40 years the present stand could be completely replaced, and the

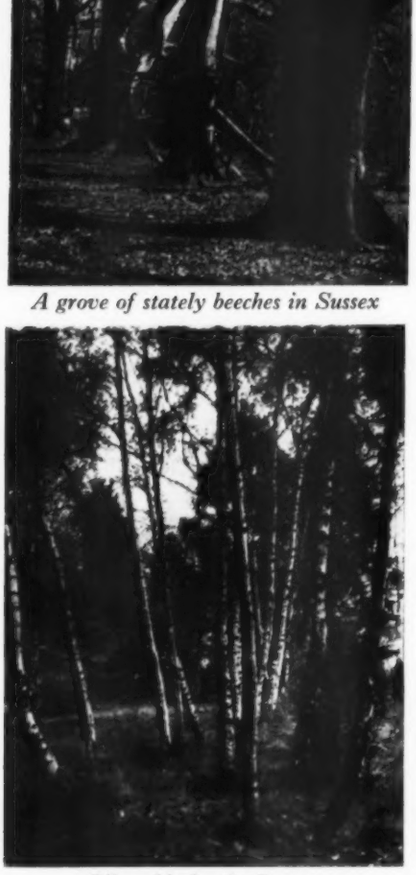
(*continued on page* 25)

The Forests of Britain

MARGARET HOLLAND

Britain was once almost covered in dense impenetrable forest and yet, in 1946, there was an acute shortage of timber in Britain. This article is a brief account of how this change came about.

A grove of stately beeches in Sussex



Silver birches in Sussex

A well-managed oak plantation in Norfolk

Photos on this page : 'Men of the Trees'

'VOORST' or 'forest' originally meant the enclosed property of the ruler, and later came to mean a reserve—the right to hunt there being reserved for the king. Then, as the royal prerogative dwindled, the forest became simply 'waste land', sometimes including wooded patches and pastures, but frequently consisting only of moorland and rough mountainside; and waste lands. Many of them still are today—lands, more often than not, of low agricultural value which never appeared to be worth cultivating.

The Stone Age

Although during the Ice Age, Britain became an empty, treeless country, this was only a relatively short period; as the climate again grew warmer, the lowlands became overgrown with dense, impenetrable forests, where savage wolves so terrified men that, even if they could, they would not have dared to venture far into them. The treeless belts of country on the higher ground, chiefly the Downs, was all that was available to the small agricultural communities of the Stone Age (about 1800 B.C.). Thus towns like Avebury, in Wiltshire, were in existence while London was still a deep forest.

The Iron Age

So the position remained until the Iron Age, about 500 B.C., when tools were made which were capable of felling trees. Then more timber was standing in Britain than at any time, before or since. Not that the coming of the axe immediately precipitated an orgy of tree felling; it was in fact, not until Anglo-Saxon times from the 3rd century onwards that the first beginnings were made at living within the forests. This was largely because the forests gave protection from troubles that occurred from time to time, along the Roman roads, south of Hadrian's Wall. The Saxon plough, drawn by eight oxen, made it possible to turn the heavy soil as it was cleared of timber, so that, for the first time, men were able to make clearings and farm them.

The Saxons

When a clearing was hacked out of the forest a 'thegn', with his dependants and servants, would settle there. Then, as the community grew, so the forest would be further cut back and more land put under the plough. When these settlements had grown into a sizable village, with perhaps 30 families, they were enclosed by a wooden stockade and took on the title of 'tun'. This has come to mean town, but 'tun' can still be found in many place names, *e.g.* Tunbridge.

Life was very hard in these early forest villages. They were entirely self-supporting, and it was only by communal effort that they managed to live at all through lean agricultural years. Certainly the trees, with their many uses, the animals that roamed the forests, and the fern, heather and other plants that grew on its fringes, were all the villagers had to supplement what they could obtain from their smallholdings.

The Vikings

The Saxon beginning of the deforestation of Britain was responsible for no more than was in the interests of good husbandry. When the Vikings came in the 8th century destruction just for the sake of it began. Later the deliberate burning of forests to rid them of outlaws and wolves caused vast areas, particularly of Scottish woodlands, to be lost.

Beginnings of industry

Then, as the population grew, and industry was born, trees were felled for many purposes: first, for making

charcoal for the smelting of iron, particularly in the Weald of Kent and Sussex and in Scotland; later for building the great Tudor houses and for shipbuilding, which took so great a toll that by the beginning of the 18th century—when still more trees were felled to make room for sheep raising—the forests had been largely denuded of hardwood. Throughout this period of continual felling little thought was given to the obvious need for re-planting.

However, while the denudation of the forests continued on this prodigal scale, there arose a competitive snobbery between the owners of some of the great estates in the matter of tree planting, each one trying to outdo his neighbour in the glory of his private woodlands—oak having the greatest appeal. These private parklands now provide an important contribution to supplies of hardwood and the U.K. Forestry Commission is not only willing, but also anxious, to help in preserving them.

This is because in 1946, following the serious depletion of Britain's forest areas during two major wars, there was an acute shortage of timber, and the proportion of woodland left standing was less than in any other country in Europe. It was, in fact, only after the last war that the seriousness of the situation was properly appreciated, and now new planting on wastelands and the replanting of the forest lands is proceeding apace. More than half of this is scheduled for Scotland.

Timber extraction from a forest in Devon, where the Forestry Commission of Britain planted its first trees after its inception in 1919. The trees are mainly Douglas fir and spruce

Planting Progress (in acres) since 1920*

Years†	*Afforested*	*Replanted*	*Total*
1920–29	101,976	36,295	138,271
1930–39	174,428	56,179	230,607
1940–49	149,868	67,254	217,122
1950	37,355	16,382	53,737
1951	38,018	19,146	57,164
1952	39,656	21,976	61,632
1953	42,665	24,945	67,610
1954	43,028	27,409	70,437
1955	40,902	27,004	67,906
1956	38,592	23,808	62,400
Total 1920–56 ..	706,488	320,398	1,026,886

*Information provided by the Forestry Commission.
† For years ended 30 September.

Tiny pines raise their heads in a forest nursery only six weeks after the seed was sown

Photos on this page : Forestry Commission

Waste land that is now considered unsuitable for planting, at least with coniferous trees, is actually very little. Just as the eight-ox plough of the Saxons made those first forest villages possible, so now giant ploughs, furrowing and subsoiling really deep, can make hitherto useless land good for forest growth.

The circle can never be fully turned but at last the pendulum, which has swung down, like an axe through the trees, through all these centuries, has begun its upward swing and with the steady expansion of forested areas the word ' forest ' may actually come to mean a ' plantation of trees '.

Forestry by Convicts

Convict labour has been used in a Zanzibar experiment to create forest plantations, part of a scheme to provide fuel supplies for towns, villages and industries. Planting has been continuing since 1950 at the rate of about 50 acres a year, in poor, sandy soil. The convicts have made themselves nearly self-supporting in food.

The Quality of Tea

(*continued from page* 23)

average crop from North-East India might well be increased to over 2,000 lb. per acre of quality tea. The best yields might be double that figure. The same promise holds for tea in other countries.

Estates which do not follow a policy of replanting with selected material are not likely to succeed in the future, since low-yielding areas will be uneconomic to work and non-quality tea will fail at the auction sales.

Still Smithfield Grows

Earls Court—shopfront for world trade in agricultural machinery and chemicals

In the more progressive countries the production of food has apparently caught up with demand, but there are parts of the world where there is still hunger and want; this will become increasingly more serious as populations continue to grow. In the under-developed countries chemical control of pests and the use of fertilisers is still regarded as having little, if any, place in agriculture and there is still considerable resistance to the mechanisation of agriculture. The potential overseas market is indeed enormous and the exhibition shows that manufacturers of agricultural chemicals and machinery are ready to make an effective contribution to the ever-increasing production of WORLD CROPS.

FARM output in Britain today is 60% greater than it was pre-war; over the same period, exports of agricultural machinery have increased by 500%. Since 1939, also, the number of tractors used on farms and smallholdings in the U.K. has increased tenfold and yet three out of every five machines produced in Britain are exported.

Positive evidence of the increasing mechanisation of world agriculture is shown by the ever-increasing exports of tractors from Britain to over 100 different countries; more tractors were exported in October than in any previous month and in the 10 months ending 31 October no less than 95,618 tractors, worth over £30 million, were sent overseas. The grand total of exports of agricultural machinery in 1957 was well over £100 million.

These astonishing achievements are also reflected in the ever-growing popularity of the annual Smithfield Show, again held at Earls Court, which is now too small to accommodate all the would-be exhibitors of agricultural machinery and chemicals, seeds and other supplies used by farmers in Britain as well as by planters, agriculturists, foresters and settlement officers in other parts of the world. This year, to add to the difficulties of accommodation, there was an all-time record entry of more than 1,647 live sheep, cattle and pigs, representative of the finest pedigree stock in Britain.

The number of new agricultural implements seems to increase in geometrical progression year by year; there were in all some 400 exhibitors in the trade section of the Show and the number of overseas buyers constituted a new record in spite of the overshadowing international situation.

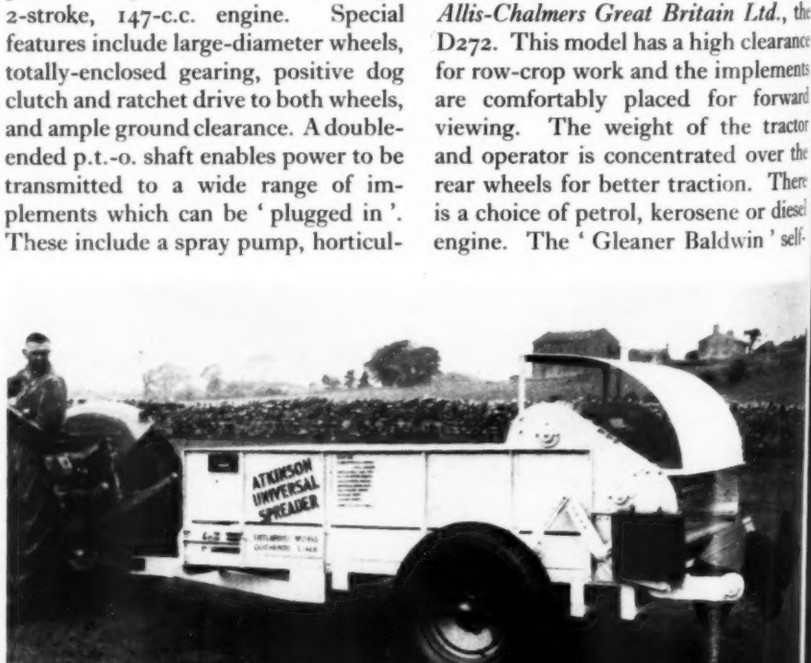
In the following pages some brief details of the agricultural machinery, implements and chemicals exhibited are given:

A

Of special interest on the stand of *John Allen & Sons (Oxford) Ltd.*, and shown for the first time, was the Universal motor scythe, Model ' F ', powered by a Villiers Mk. 25C 2-stroke, 147-c.c. engine. Special features include large-diameter wheels, totally-enclosed gearing, positive dog clutch and ratchet drive to both wheels, and ample ground clearance. A double-ended p.t.-o. shaft enables power to be transmitted to a wide range of implements which can be ' plugged in '. These include a spray pump, horticultural plough, circular saw, precision hoe, cultivator, cylinder mower, snow plough and hay sweep.

Allen & Simmonds (Auto Culto) Ltd. Shown for the first time was the new ' Horti-Culto ', a cultivator powered by a Villiers 4-stroke engine, developing 1 b.h.p. at 2,700 r.p.m. The engine has ample power for digging to a depth of 9 to 10 in. The machine has attachments for hedge trimming and hoeing, for deep digging and mowing and an 18-in. rotary cutter for clearing ground of long grass, bracken or scrub.

A new tractor was exhibited by *Allis-Chalmers Great Britain Ltd.*, the D272. This model has a high clearance for row-crop work and the implements are comfortably placed for forward viewing. The weight of the tractor and operator is concentrated over the rear wheels for better traction. There is a choice of petrol, kerosene or diesel engine. The ' Gleaner Baldwin ' self-



A manure, lime and fertiliser spreader which can also be used as a self-unloading trailer

The ' Lincol ' ditch and dyke cleaner in action

propelled combine-harvester and the ' Roto-Baler '—the only machine to produce round bales—were also on view.

E. Allman & Co. Ltd. were showing for the first time their new tractor-mounted sprayer which is primarily designed for the large grower of potatoes, though it can also be adapted for spraying cereals and cotton. Known as the ' Sprayall 100 ', it has 100-gal. capacity tank and the boom assembly carrying nine droplegs is so designed that by using the tractor's hydraulic lift the assembly is lifted vertically to clear the haulm and then automatically folds along each side of the tractor. Meanwhile, a shut-off valve stops the spray. Thus by the one simple movement of the tractor's hydraulic lift the operator has complete control over the machine. Among their other exhibits were included their new Model 30 portable sprayer, mounted on a truck with four rubber wheels, and the new 600 × 36 row-crop tractor wheel attachment, designed to fit the leading tractors.

Alperson Products Ltd. were showing their low-loading ' Tiptow ' trailer, which has previously been described in WORLD CROPS, 1957, **9**, 335.

Armstrong Siddeley Motors Ltd. had on display a range of single-, twin- and 3-cylinder, air-cooled, cold-starting diesel engines, with power ratings from 6–33 h.p., suitable for driving pick-up balers, cutter loaders, sawbenches etc. and also for industrial use, *e.g.* generating sets, mobile welders, air compressors etc.

Atkinson's Agricultural Appliances Ltd. had on show a new model of the 'Spreadall' lime and fertiliser spreader, the Mk. IV. New features are direct drive from the p.t.-o. in place of ' V ' belts and pulleys, loading height reduction to 54 in. and sealed self-lubricating bearings. The Mk. IV can be supplied with special wheels for operation on soft or boggy ground.

The 'Universal' spreader illustrated on the opposite page was also shown.

Automotive Products Co. Ltd. exhibited a wide range of components for tractors and agricultural machinery, including Lockheed mechanical brakes, Borg & Beck clutches, Rockford p.t.-o.s, the recently-developed 'Purolator ' air filter, Lockheed Avery hoses and couplings, and the new Thompson self-lubricating steering joint.

B

J. C. Bamford (Excavators) Ltd.. The ' Hydra-Digga ' was exhibited with its ditch-digging and cleaning attachments, which consist of a ditching bucket and ditch-cleaning blade for cutting dykes and agricultural ditches.

The ' Loadall ', which is a new implement for tractor attachment, is being used for back-filling and carrying pipes for land drainage; for muck shifting; for fruit picking and lifting corn and meal to a higher level with the platform attachment; for lifting timber with crane-hook attachment; and for stockyard clearing.

Barford (Agricultural) Ltd. had on display the ' Atom-15 ' multi-purpose two-wheeled tractor, a power scythe, the ' Rotomo ' rotary grass cutter, farm food cooking and dairy sterilising equipment, and the ' Lincol ' ditch and dyke cleaner, which can operate to a depth of 3 ft. 6 in.

A. B. Blanch & Co. Ltd. showed their comprehensive range of farm

Reader Service

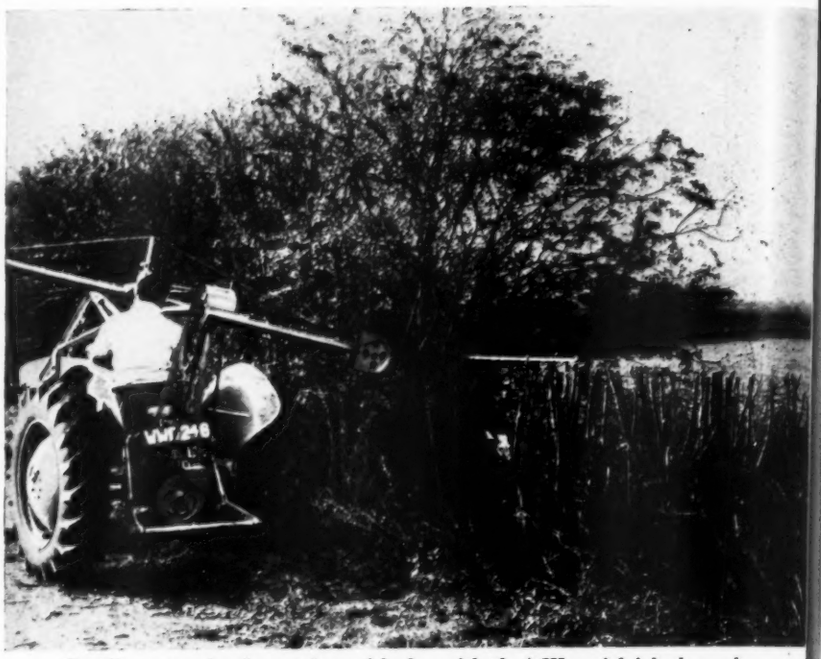
For further information on any item of machinery or equipment reviewed in this issue please write to:

Reader Service,
WORLD CROPS,
Leonard Hill House,
Eden Street, London N.W.1,
England

A rake and swath turner by A. B. Blanch & Co. Ltd.

implements and machinery, including the ' Triplefit ' broadcaster, the P.D.4 manure spreader, the F.D.5 fertiliser spreader, the any-level ' Universal ' elevator and the ' Whirlwind ' forage harvester.

The most outstanding exhibit of *Bomford Bros. Ltd.* was the ' Warwick ' hedgemaker, a most useful machine for any farmer who owns a tractor. The machine has been specially designed to have a long reach and yet produce a level cut, for it will be appreciated that a ground inequality of 2 in. between the wheels of the supporting tractor would produce a rise and fall of 1 ft. at the extreme end of a long cutter bar. To overcome this the makers have introduced the floating beam principle to counteract the rolling movement of the tractor, thus ensuring that the hedge is uniformly trimmed and not mutilated. They have succeeded in doing this with one-man control.

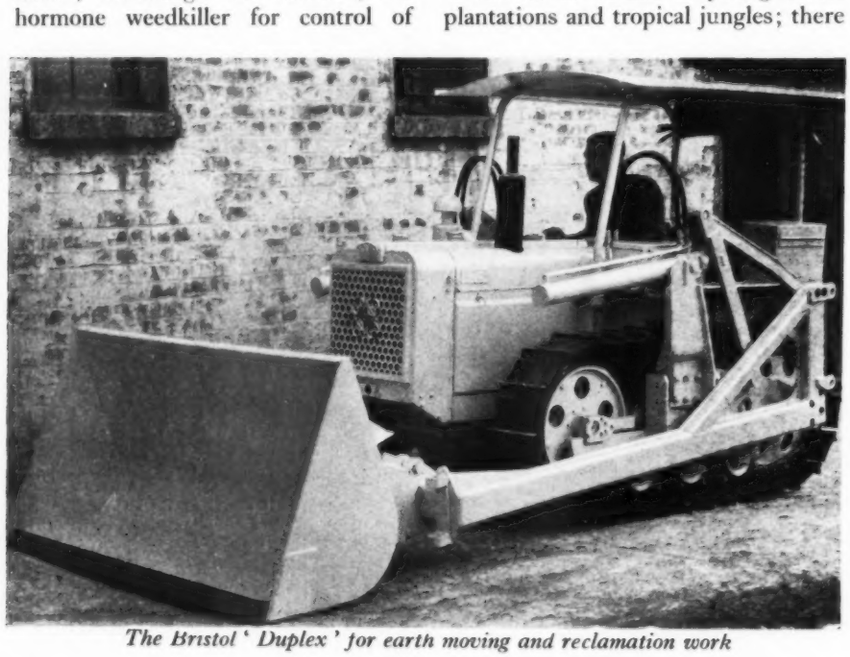


Cutting a previously untrimmed hedge with the ' Warwick ' hedgemaker

Bomford & Evershed Ltd. The ' Sapper ' earthmover Mk. IIB and the ' Sapper ' ditcher were the principal exhibits. The sturdy blade of the earthmover can be angled and tilted. In the angledozing position the blade can be offset to cover one wheel track, thus allowing it to be worked close to a wall or fence. The ditcher is of the bucket type and is semi-mounted on a medium - powered wheeled tractor.

Boots Pure Drug Co. Ltd. The ' Cornox ' range of selective weed-killers, including ' Iso-Cornox ', the hormone weedkiller for control of cleavers, was featured, together with other crop sprays. ' Iso-Cornox ', first introduced at the 1956 British Weed Control Conference, has since been tested and proved under practical conditions by farmers in Britain and is equally effective overseas.

Bristol Tractors Ltd. were again exhibiting their sturdy crawler tractor, the ' Bristol 25 ', which is adaptable to almost all working conditions. On view was a special tractor with a 37-in. overall track for work in closely-spaced rows or in very confined places, such as are to be found in young forest plantations and tropical jungles; there was also a model with a 44-in. track centre and an over-all width of 54 in., fitted with a Boughton winch for haulage and other work in forests, and yet another, the ' Duplex ', fitted with a combined dozer and loading equipment, which was being exhibited for the first time. The dozer blade is quickly interchangeable with a loading bucket of approximately ½ cu. yd.



The Bristol ' Duplex ' for earth moving and reclamation work

The principal tractor exhibit of the *David Brown Companies* was the David Brown 900 ' Livedrive ' tractor with live p.t.-o. and live hydraulics, the latest version of the 40-h.p. diesel model, introduced a year ago. The David Brown vineyard 2D tractor was also shown for the first time. It is a narrow version of the standard 14-h.p. diesel machine, designed specifically for inter-row cultivation of vineyards, hop-fields, orchards etc. There were also four entirely new David Brown ' Albion ' implements: a pick-up baler, forage harvester, rotary tiller and front loader.

C

C.A.V. Ltd. had on their stand a representative selection of diesel fuel injection equipment and electrical equipment for agricultural tractors and for stationary and portable engines. The type ' F ' paper element fuel oil filter shown will be very useful to those who operate machines in dusty conditions.

The ' thermostart ' starting aid for

diesel engines will operate at temperatures as low as 10°F (−12°C).

J. W. Chafer Ltd. On view for the first time was their chemical research sprayer, designed for the easy comparison of different dilutions of the same formulation. An infinitely variable concentration can thus be applied.

Christy & Norris Ltd. As well as exhibiting their 'Essex Major' automatic hammer mills, a combined mill and mixer was shown for the first time. This unit consisted of an 'Essex Major' mill delivering direct into a 10-cwt. 'Quickmix' mixer. These mills may be driven by electric motor, by petrol or diesel engine, or by belting from a shaft.

Robt. Ingham Clark & Co. exhibited a complete range of their 'Britannia' finishes for agricultural equipment; these can be supplied in both stoving and air-drying qualities.

Clifford Cultivators had on show a Mk. 4 Clifford cultivator, powered by a Sachs 500 diesel engine which requires only 1 gal. of fuel for eight hours' work. Also on this stand was a standard Mk. 1 cultivator, together with a 6-in. narrow inter-row unit and other ancillary equipment.

J. W. & T. Connolly Ltd. exhibited their welded-steel trailers, which combine strength with easy running. Also shown were 'Atcon' rubber tracks, which can be usefully fitted not only to machines subjected to exceptionally arduous conditions, but also to machines for low ground packing, such as seeding, harvesting and drilling machines. They are particularly suitable for work on sugar-cane plantations, in rice fields, bogs and deserts, in land reclamation and forestry, and for carting winter crops from muddy fields. There were also steel tyre conversions, which increase the effective pull.

Cooch & Sons Ltd. exhibited their potato washers, driers and sorters, a vegetable washer and winnowing machines. The spool-type potato sorter will size potatoes without damaging them and they are turned over and over on the rollers of the conveyors of these machines, so that any diseased or defective ones can be removed. The No. 4 winnower is suitable for dressing either cereal or grass seeds and for corn harvested by combine it can be used either as a cleaner before drying or for final dressing after drying. Its capacity is from 1½ to 2 tons per hour. They also showed brushing machines for dry cleaning potatoes and other root crops.

Cooper, Pegler & Co. Ltd. demonstrated a quick and easy method of watering pots and beds in greenhouses, frames and even in the open with a spray lance, which is connected direct to the mains tap and has an instantaneous control. Their lance is fitted with a special nozzle and can be connected to a ⅜-in. or ½-in. hose pipe and the instantaneous control gives immediate shut-off when required.

The narrow version of the David Brown 14-h.p. 2D is here being used for inter-row work on runner beans

D

The main item displayed by *Denings of Chard Ltd.* was the new 'Somerset' fully-mounted mower. Other exhibits included the 'Somerset' 12-row and 16-row self-lift grain and fertiliser drills, 7-ft. 6-in. tandem disk harrow, potato digger, 12-tine buck rake and 'Master' transportable and 'N.E.W.' saw benches.

Dorman Sprayer Co. Ltd. were exhibiting for the first time an entirely new range of trailer-mounted sprayers with spray tanks of different sizes and designed for high-, medium- and low-volume spraying, using a variety of spray booms and nozzles. They have also added a new 200-gal. trailer sprayer to their range of tractor-drawn sprayers.

Drake & Fletcher Ltd. introduced a new development in tractor-mounted sprayers, the 'Unimount' mistblower. Designed both for high- and low-volume spraying, the high-pressure pump and the twin adjustable fans are all mounted on the 3-point linkage. The sprayer is fitted with the 'Unimist' unchokeable nozzle system and the liquid tank, which is trailed, is agitated by paddles, actuated by the wheels. The 'Zero-fifty' mistblower, also shown, is a different approach to the problem of low-volume and concentrate spraying. There is no pump, the spray being air-assisted by the twin adjustable fans, which are mounted on the tractor and operated through the 3-point linkage. The Mk. 2 'Cob-in-sack' grain drier, also on this stand, has an oil-burner and a fan unit, electrically operated, and there is adequate protection in case of flame failure.

Dunlop Rubber Co. Ltd. had on show many examples from their range of agricultural tyres, and making its first appearance was the T.F.9 front tractor tyre, designed to give positive steering on any type of soil and with extra strong side walls to give protection against snags and severe impact. Also included in the exhibit was a panel showing specimens of transmission belting and a display of farm boots. A disk brake for tractors was shown for the first time.

E

Enfield Industrial Engines Ltd. were showing for the first time the Enfield

350-c.c. high-speed, light-weight, air-cooled diesel engine, designed to produce 5 b.h.p. at 3,000 r.p.m. This unit, the first of a new series of light-weight, high-speed, air-cooled diesel engines, weighs under 200 lb. and incorporates many novel features. This engine is recommended as a prime mover for elevators and conveyors; for balers and grass driers; for cultivating and hoeing units; for mowing machines and hedge trimmers; and for diggers, ditchers and dumpers. Their '85' and '100' single- and twin-cylinder air-cooled engines were also on show.

F

Farrow & Sons Ltd. presented a remarkable table display to illustrate the 'Gulle' system of liquid-manure farming as practised in Germany, Switzerland and Austria. On the same stand was to be found their rain gun and sprinkler system with light-weight aluminium piping, 'Hy-speed' quick-coupling connections and a complete range of fittings, including their self-closing valves.

The Firestone Tyre & Rubber Co. exhibited many examples of their agricultural tractor, horticultural, implement and industrial tyres and tubes.

The B.100 beet harvester, the centre-piece of the display of farm implements shown by *Fisher, Humphries & Co. Ltd.*, has been designed for both large and small growers of sugar-beet. It is a small, sturdy machine, with few wearing parts, so reducing the incidence of repairs and loss of valuable working time during harvest.

J. A. Fishleigh & Son Ltd. Among the exhibits were vaporisers for converting petrol engines to vaporising oil, a mid-mounted hedge-cutter, a sack and bale lifter, and a rotating swath for mowing grass and hay-making.

Ford Motor Co. This year saw the first public showing of the new Fordson 'Dexta', which is powered by a new 3-cylinder diesel engine, developing 32 b.h.p. at 2,000 r.p.m. The engine drives through a single dry plate, 11-in. diameter clutch to a 6-speed, constant-mesh gearbox, giving a range of speeds from less than ½ to over 17 m.p.h. Hydraulic lift and linkage is standard equipment on this tractor and one single lever conveniently located near to the driver's right hand is employed to operate numerous hydraulic services.

G

The new *Gascoigne* Mk. 2 grain drier, which was exhibited by this company for the first time, is designed for use either as a continuous-flow or as a batch drier. The intake hopper incorporates pre-cleaning screens—the first removing large trash, such as thistle heads and straw, and the second the dust and small weed seeds. Power is provided by a 5-h.p. and a 2-h.p. motor. The output is rated at from 1 to 2 tons per hour.

H

The Harvest Saver & Implement Co. Ltd. were exhibiting for the first time the equipment needed for their mobile 'H' grazing system, using four separate fences with one continuous electric circuit. Each of these fences can be moved, lengthened or shortened independently of the others. The H.S.I. mechanical bale stooker was also shown.

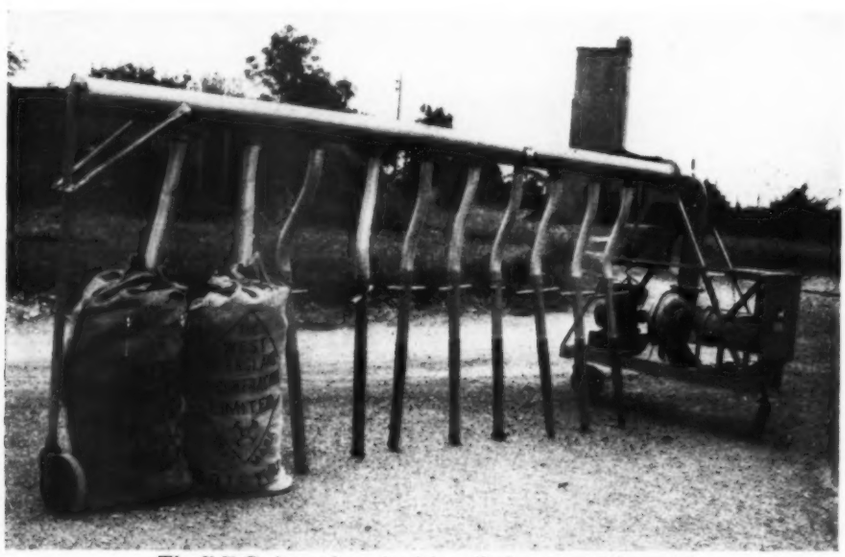
Hayters (Export) Ltd. Besides their standard hand and motorised rotary scythes, this company were showing for the first time an entirely new model—a 6-ft. trailed motor scythe for attachment to the p.t.-o. of a standard tractor. This machine, which can be extended with two 4-ft. wings to give a 14-ft. cut, is to be known as the Hayter '6/14'. It will cut grass 2 ft. high, as well as heather, bramble, thistles, docks and other heavy weeds, even in adverse weather conditions. The area that can be covered with the fully extended machine is now more than doubled and approximates to 8 acres an hour at a tractor speed of 5 m.p.h.

I

The *India Tyre & Rubber Co. Ltd.* showed a complete range of agricultural tyres, designed for all types of tractors, trailers, carts, implements and other agricultural appliances for working in all conditions. Great prominence was given to the India range of super-grip tractor tyres, available in both open centre or continuous bar tread designs. The former is designed for use on clay and other types of heavy or hard-packed soil and keeps the tractor moving in the worst conditions. The continuous bar tread is more suitable for light or friable soil, grassland, stubble and road work.

International Harvester Co. of Great Britain Ltd. The new International BTD-640 crawler tractor was on show for the first time. An agricultural version of the industrial BTD-6 tractor, the new BTD-640 has been engineered specifically for the agricultural user. Basic specification includes the 4-cylinder, 42-b.h.p., BD-264 o.h.v. diesel engine; clutch and brake steering; 12-in. clipped corner track shoes and 3-point track suspension designed to give maximum ground contact over rough terrain without distortion.

Another newcomer was the B-45 pick-up baler Mk. 2, a bigger capacity machine than the earlier B-45, having an output of up to 7½ tons per hour.



The J.E.C. in-sack grain drier all-electric mobile model

The ' Motoconomist ' spraying vines. The centrifugal pump can apply up to 100 gal./acre

J

The *Jeffrey Engineering Co. Ltd.* The J.E.C. in-sack grain drier was introduced to meet the requirements of the small farmer, whose normal practice it is to keep grain in sacks until it is collected by the miller. Two types were exhibited, one with an engine-driven fan and Calor-gas heating, and the other an all-electric model with an electrically-driven fan and heating unit. Both models were of 2-ton batch capacity. The method of operation is to insert into the sacks a probe, which has 50% of its surface perforated to allow warm air to pass into the grain under pressure.

Jones Balers Ltd. exhibited for the first time at Smithfield their ' Pilot ' combine and the Jones ' Tedder ', a machine for hay-making and for turning swaths, which is p.t.-o. actuated. The drawbar of the machine can be swivelled to the end of the frame, when it has to be moved through narrow lanes and gate ways.

K

The *Kent Engineering & Foundry Ltd.* showed five new machines for the first time at Smithfield—the ' Conomist ' 110 mistblower with concentrate attachment, the ' Powermist ', the ' Motoconomist ', the tractor-mounted ' Conomist ', and the ' Motoblo ', a shoulder-mounted machine. The ' Motoconomist ' is a self-propelled 5-h.p. mistblower for work in soft fruit orchards, in vineyards and in coffee plantations. The tractor-mounted mistblower is fitted to the 3-point linkage and is specially designed for work in rough terrain.

L

Pride of place on the *Lister-Blackstone* stand was given to the Vicon-Lely ' Acrobat ' hay-making machine. This fits on to the 3-point linkage of a tractor, is adjustable and will turn two 5-ft. swaths at high tractor speed or rake two swaths into one for baling. In the third position the machine will spread the crop to assist drying. Other machines shown included an improved version of the Lister fertiliser broadcaster introduced at last year's Show.

Lundell (Great Britain) Ltd. After extensive trials under various conditions a new forage harvester was on exhibition for the first time. It is a flail-type harvester which chops, lacerates and loads forage crops for silage and green feeding; it also has many other uses, including the harvesting of kale and maize, sugar-beet topping and scrub clearance. The lacerated crop is thrown up through a swivel-head chute into the accompanying trailer.

M

J. Mann & Son. Ltd. were showing the Claas self-propelled combine-harvester and straw chopper, which is a tanker model, driven by a Perkins L4 engine. Also on view were the Claas high-density and low-density pick-up balers. The former has a capacity of 4–5 tons per hour; the latter has a capacity of 4 tons per hour.

Marshall, Sons & Co. Ltd. (and John Fowler & Co. Ltd.). Six Track-Marshall standard diesel crawler tractors were displayed, each fitted with a different implement. Forestry equipment shown included a Boughton heavy-duty haulage winch, bush guard, bumper bar and protective undershield. Seen for the first time at Smithfield was a new fixed-type hydraulic bulldozer, a heavy-duty hydraulic toolbar and a hydraulic angledozer.

Martin's Cultivator Co. Ltd. showed the latest additions to their range of agricultural machinery — the new Markham ' Superdrive ' gear-driven fertiliser broadcaster, a two-wheeled trailer model with all moving parts enclosed. There was also the new Markham combined mixing and milling unit; the meal mixer has a capacity of 20 cwt. and is powered by a 5-h.p. electric motor. The ' Comet Major ' mill, which is incorporated, has a 10-h.p. totally-enclosed dust-proof

The new Lundell forage harvester

motor. The output of this unit is 2 tons per hour.

Massey-Harris-Ferguson. A new tractor, the Massey-Ferguson 65, shown to the public for the first time with a new brand-name, a new company symbol and in new colours—red and grey—also offers many new features, including power steering, differential lock, disk brakes and a choice of Category 1 or 2 hitches. Its hydraulic mechanism has a 30% greater output and over 40% greater link lift than the Massey-Ferguson 35.

With the growing preference for diesel fuel for farm use this new model will be made only with a diesel engine.

May & Baker Ltd. displayed a range of selective weedkillers to meet the varied needs of agriculture. In addition to 'Planotox', 'Agritox', 'Tropotox' and 'Spontox', they introduced four new products: 'Tropotox plus' for the better control of cruciferous weeds, such as charlock and runch; 'Varitox', a TCA selective weedkiller for wild oat and couch grass; 'Embutox', a 2,4-D formulation, for safe weed control in seedling lucerne and white clover; and 'Compitox' for the general control of weeds in cereals.

Micron Sprayers exhibits were designed to show the latest developments in concentrate sprayers and included the 'Micronette', the 'Micron Meg' Mk. 2 and the 'Micronair' rotary atomiser. Two models of the 'Micronette' were shown—a shoulder-mounted model and one handily mounted on a mono-wheel. The former is already in use for spraying coffee and cocoa and it is also designed for the treatment of sugar-beet; the latter is for work in plantations, market gardens, nurseries and fruit orchards.

The latest version of the 'Micronair' rotary atomiser, for mounting on agricultural aircraft, was also shown.

The selective effect of 'Embutox', 2,4-DB, on docks in lucerne, which is unaffected

The Mi-Dox Co. R.S.M. sprayers on display included a trailer sprayer with a 175-gal. teak tank, 3-cylinder pump capable of pressures up to 600 lb. per sq. in. with an output of 10 gal. per min., and fitted with 8-spout p.t.-o.-driven mist-spray attachment for the double-sided spraying at high or low volume of trees up to 30 ft. high; a tractor-mounted sprayer with a 65-gal. pine tank, a single-cylinder pump with an output of 5 gal. per min. at 400 lb. per sq. in., and fitted with a single-sided mist-spray attachment; and a similar tractor-mounted sprayer with a 2-cylinder pump with an output of 10 gal. per min., and with 10-spout mist-spray attachment for double-sided spraying at high or low volume of hops or bush trees in rows up to 20 ft. apart.

The new 'Massey-Ferguson 703' baler designed for the small farmer, which is very manoeuvrable

Shown for the first time by *Minok Engineering Co. Ltd.* was the 'Motohak' cultivator. The basic unit comprises a 3½-h.p. sturdy 2-stroke engine with all-enclosed gearbox and chain drive to the cultivator shaft. The machine, which is light enough to be carried by one man, has no wheels and thus can work under all conditions and up the steepest slopes. The engine is mounted vertically above the tines, so keeping it out of the dirt, and the air for the engine is drawn through corrugated replaceable filter paper. Attachments shown were the earthing-up plough, the second gear high-speed guard and front wheel attachment, a 6-cwt. trailer and various types of tines and plant protection disks.

A new item on the stand of *Mitchell, Colman & Co. Ltd.* was the 'Stoll' automatic potato planter, which is available as either a 2- or a 3-row machine. A correcting container ensures that each seed cup is loaded and there are therefore no misses.

The other new items were the 'Koela Combi' self-propelled combine-harvester, the 'Yeoman' precleaner and a scale model of the 'Emceka' grain drier.

N

Ch. J. Neuman Ltd., manufacturers of 'Nubrex' greasing equipment, were showing for the first time a snap-on, universal swivel nozzle with a hydraulic flexible coupling of rubber hose capable of withstanding the enormous pressure of 15,000 lb./sq. in.

Newage (Manchester) Ltd. had a special display of prime movers for farm machinery. These included the Newage/B.M.C. 4,000-c.c. high-compression petrol engine specially built for powering the Massey-Harris '780' self-propelled combine-harvester; the 1,500-c.c. low-compression engine, which is fitted to the Massey-Harris '735' self-propelled combine-harvester and operates on vaporising oil; the 2.2-litre diesel engine, which powers the German Claas combine-harvester; and the 2,200-c.c. high-compression petrol engine, which is the prime mover of the Belgian Leon Clacys combine-harvester.

W. N. Nicholson & Sons Ltd. were showing their improved rear toolbars and their new centrifugal broadcaster which will deliver basic slag, ground limestone and granular fertilisers in a 180° arc at the rear of the machine and

when travelling at 5 m.p.h. will produce a 30-ft. band.

A full range of *Nuffield* ' Universal ' tractors was on show, but the centre-piece was the working sectioned model of the new Nuffield ' Three ' tractor, rotating on a turntable. This is a 3-cylinder, 2.5-litre, diesel-engined model, which is slightly smaller than the ' Four '. A special feature of this new model is its 5-speed and reverse gearbox and its unit construction. Its linkage is designed to accommodate category 1 and category 2 implements, and there is a high degree of interchangeability of spare parts between the two tractors.

The ' Micronette ' mounted on a single-wheel reversible trolley

Nu-way Heating Plants Ltd. Shown for the first time, the Nu-way Y.30E oil-fired air heater and fan unit is suitable for grain-drying installations with outputs up to 2–3 tons per hour and for hop-drying installations. The hot-air temperature can be controlled either at a pre-set figure or to follow a timed cycle. Other exhibits were the latest model of the ' N-H ' tipping-tray grain drier, the Nu-way Y.18 oil-fired drier unit and various types of oil burners for farm use.

O

Jack Olding & Co. Ltd. were showing the ' Hatfield ' manure spreader, which combines large capacity —3 tons —with land-wheel drive; the Boby ' Unidresser ' and triple elevator, a small-scale grain- or seed-cleaning installation; and the John Deere automatic wire-tying pick-up baler.

Opancol Ltd. exhibited a wide range of agricultural supplies. The ' Quick-test ' hygrometer for moisture testing of grain in bins, bulk and sacks and the ' Silometer ', a dial-type stem thermometer for silage, hay or grain, attracted interest. Among other equipment shown was the ' Foggit ' atomiser, a conveniently small bottle sprayer for the protection of cattle against disease due to flies, bacteria etc. There was also a high-pressure water pump — the ' Neptune ' — for washing down tractors and implements and keeping farm buildings free of dirt and disease.

Their ' Vacuum-silo ' system is a new approach to silage making. The material is first stacked into shape using a steel ring, a heavy plastic dome cover is then placed over the stack and then the air is evacuated.

P

Penny & Porter Ltd. showed three ' first-time ' exhibits—a new ' Lincoln ' grain drier, the ' Lincoln-Proctor' tripod loader and the 'Terrier' conveyor for working in conjunction with the drier. In addition, they had a full range of their other products—grain cleaners and graders and their rotary adjustable screen. The tripod loader is designed to reduce labour requirements and increase output; it consists basically of a cage mounted on a 2-wheel chassis for drawing behind a standard tractor. The tripods of hay built with this implement are of equal size, shape and density. The ' Terrier ' conveyor is designed for the emptying of flat-bottom storage bins.

F. Perkins Ltd. were showing for the first time a new 1.6-litre British diesel engine, known as the ' Four 99 (TA) ', which incorporates a new, patented combustion system. It is particularly suitable for small self-propelled combine-harvesters, small tractors and other farm machinery. The engine develops 35 b.h.p. at 3,000 r.p.m. and weighs only 456 lb. and it incorporates the C.A.V. distributor-type fuel pump, which can be fitted with either mechanical or hydraulic governors.

Another agricultural diesel engine making its debut was the 4-cylinder ' P4/192 (TA) ', rated to give from 25 b.h.p. at 1,000 r.p.m. to 50.5 b.h.p. at 2,000 r.p.m.

Petters Ltd. had on display 11 of their range of diesel and petrol engines, both air-cooled and water-cooled and single-, twin-, 3- and 4-cylinder models.

Philip Pierce & Co. Ltd. had a wide range of agricultural implements on view and for the first time their new tractor-mounted broadcaster with a discharge width of about 30 ft., while the rate of spreading is controlled by a single lever. The machine incorporates its own stand, making it easy to store.

Plant Protection Ltd. were exhibiting a comprehensive display of their latest agricultural chemicals with a series of photographs to illustrate the effects of the use of a wide range of weedkillers, insecticides and fungicides used in agriculture in all parts of the world.

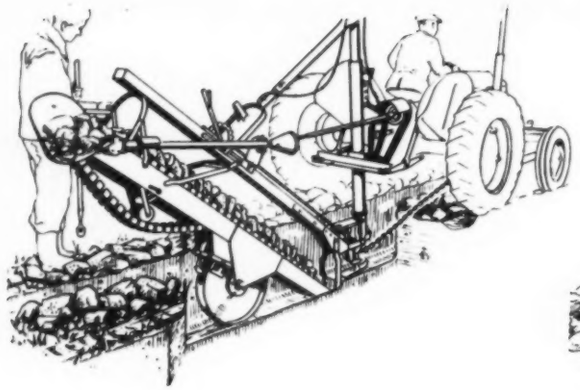
The *Plessey Co. Ltd.* displayed a representative selection of hydraulic rams, pumps and control valves, exemplifying the increasing use being made of hydraulic equipment in all types of agricultural machinery.

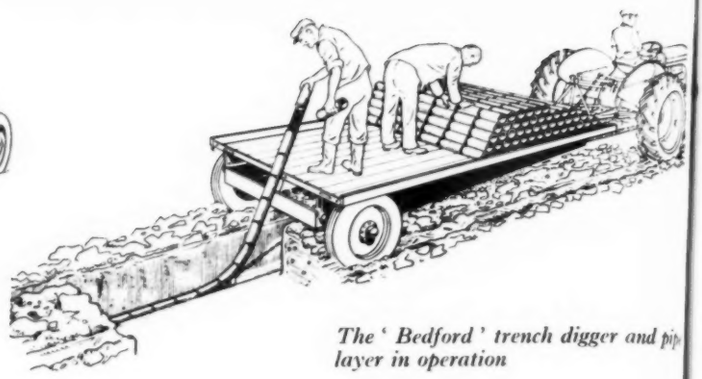
R

On show for the first time at Smithfield by *Ransomes, Sims & Jefferies Ltd.* was the very manoeuvrable MG6 crawler tractor, fitted with a diesel engine. They also introduced a selection of their new agricultural implements, including various types of plough, a steerage plough and a trailing disk harrow. Also on view were a range of their ' Cropguard ' sprayers—the smallest with a 17-ft. boom and a 30-gal. tank and the largest having a 100-ft. boom and a 100-gal. tank. Of special interest to smallholders and horticulturists was the ' Vibro ' hoe with its reciprocating blades and a single wheel.

Renold Chains Ltd. displayed a complete range of their transmission and conveying chains and wheels for agricultural machinery, including the corrosion-resistant Mk. 5 series designed as a replacement for malleable chains.

The ' Motohak ' cultivator in action





The ' Bedford ' trench digger and pipe layer in operation

William Reynolds & Sons Ltd. exhibited the ' Bedford ' trench digger and pipe layer, their new onion harvester, an angle blade and the S.B.C. straw trusser. The first is particularly suited to the needs of the farmer for the laying of agricultural pipes with the minimum of labour and at high speed. The digger can be quickly attached to the 3-point linkage of the tractor and a succession of 4-in. cuts are made until the required depth, down to a maximum of 40 in., is reached. Operating speeds are from 30 to 170 yd. per hour. The pipe layer provides a quick and efficient method of laying 3-in. and 4-in. agricultural pipes.

Romac Industries Ltd. were showing the RT/M9 air compressor for agricultural and industrial purposes. The 90° twin-cylinder formation provides uniform heat dissipation and the deep fins are designed to give greater cooling. It is mounted on two wheels and is portable even over rough ground.

Two new items of sugar-beet equipment were shown for the first time by *Root Harvesters Ltd.*—the ' Todd ' down-the-row thinner and the ' Todd ' beet chute, a useful unit for screening out loose soil when loading beets. Also shown was the Whitsed ' RB ' potato harvester, which produces a clean product.

Rotary Hoes Ltd. An ' H '-type trailing ' Rotavator ' which will give a 70-in. cut and suitable for tractors in the 45–65-b.h.p. range was exhibited, together with ' E ' mounted and ' E ' trailing ' Rotavators ' for tractors from 25–45 b.h.p. Also on show were the EMO 50-in. coffee ' Rotavator ', the EMO 40-in. sugar-cane model and the diesel ' Gem ' wet rice model.

Russell's (Kirbymoorside) Ltd. were showing seed-spacing drills, seed and fertiliser placement drills, down-the-row thinners, the ' Kwikset ' steerage hoe, a duo-level elevator and two planters—the Mk. III, a robust planter for tropical and semi-tropical crops, designed for continuous or space planting of undelinted cotton and all types of hard seed, and the Mk. IV, a similar machine, but built for hand operation or animal towing.

S

Scottish Mechanical Light Industries Ltd. The agricultural machinery shown by this firm included the new ScotMec 5-ton batch drier and their combined hammermill and mixing installation. The drier is a complete self-filling and self-emptying system for treating grain received direct from the combine and delivering it in a dry condition to the granary. The drier is a self-contained unit requiring no foundations, and heat can be supplied either from an electric heater or an oil burner, or else waste heat may be used. The dried grain may be conveyed pneumatically to the granary, or it may be bagged off, or it may be fed into the hammermill.

J. E. Shay Ltd. had on show the 1958 version of the Shay ' Rotogardener ', which now has an improved clutch, adjustable handles and a recoil starter for its 120-c.c., 2-h.p. engine. The new handles are adjustable for height and can also be swung to either side of the machine.

Simms Motor Units Ltd. had on display a wide range of accessories for agricultural equipment, tractors and stationary engines, including the inertia starter Type 6, a manually-operated starter suitable for diesel engines. A feature of the starter is the variable transmission between the flywheel and pinion, which obviates the use of a friction clutch.

Smiths Motor Accessories Ltd. showed a wide range of tractor instruments and accessories, including engine service counters and hour meters which can be used to indicate the need for oil changes and maintenance overhauls as well as the time on which to assess working costs or hire charges.

Spenborough Engineering Co. Ltd. showed a complete range of their hydraulic trailer rams, tipping gears, pumps, valves and oil seals.

F. A. Standen & Sons Ltd. had on display a complete range of their potato, carrot and sugar-beet harvesting machines and cultivating implements for attachment to the 3-point linkages of tractors. The rotary hoe has four independently mounted tines which follow closely the contours of the land; if the tines strike a resistant object, that section automatically lifts, thereby avoiding damage to blades and without holding up the work. Their carrot harvester very ingeniously works two rows ahead of the machine so that the carrot tops are not flattened by the wheels of the tractor. The ' Beet-Master ' offers an entirely new approach to the saving of sugar-beet tops in a clean and undamaged condition.

Among the exhibits of *Stanhay (Ashford) Ltd.* were a seed-spacing drill suitable for sugar-beet, mangolds, kale, peas, maize, groundnuts, sorghum, soya bean, jute etc.; a ridge drill with special frame and conical rollers; the hydraulically-operated ' Ditchmaster ', a tractor-mounted machine for cleaning all types of ditches or digging new ditches; and a hydraulically-operated hoist and loader with a comprehensive range of grabs for manure bales, sacks, barrels, lime etc.

Steel Fabricators (Cardiff) Ltd. were showing two loaders for the first time. The ' Shawnee ' special loader will lift 2,000 lb. to a height of 10 ft. 6 in. attachments include fork lift, boom etc.

tension, angledozer blade, bulldozer blade and 42-in. and 66-in. buckets. The new 'Horn-draulic' loader will lift 1,600 lb. to a height of 14 ft.; attachments are also available for this model, enabling the loader to be used for heavy digging and clearing, levelling, bulldozing and, with the loader boom, for high lifting jobs, such as tearing down haystacks.

Also on show were the 'Horn-draulic' shredder, a push-off buck rake, the 'Shawnee' scout digger, capable of trenching to a depth of 12 ft., and the 'Horn-draulic' post-hole borer.

T

Taskers of Andover Ltd. showed their new implement, the 'Arthur' rotary slasher, for attachment to the tractor p.t.-o. This is a heavy-duty machine for clearing rough ground of scrub and bracken by the action of four chains which are rapidly rotated a few inches above ground level as the tractor moves forward or backward. All growth is slashed off to a working width of 8 ft. The average operating speed is in the region of 5 m.p.h., subject to conditions. Other tractor implements shown included an earth scoop, a buck rake and a grader blade.

Tarpen Engineering Co. Ltd. exhibited a trimmer for cutting garden and ornamental hedges; an electric chain saw, which has a cutting capacity of over 10 in., yet weighs only 14½ lb.; a hoe/tiller, which is primarily intended for rose beds and herbaceous borders; the 'Hedgemaster', which is larger than the trimmer and with a cutting capacity of ¾ in. is ideal for field and roadside hedges; and other electrically-driven equipment for cutting grass or weed growth.

Trojan Ltd. The Trojan 'Airator' has made its debut. This is a mobile unit for crop conditioning and is a neat assembly of engine, fan, combustion chamber and heat exchanger, mounted on a rigid 2-wheel chassis. The specially designed heat exchanger completely eliminates the risk of crop contamination or fire, and there are safeguards for flame failure or excess heat. It can supply cold or heated air, according to requirements, for drying grain in sacks, bins and silos, for drying hay and grass, for hop drying and for blowing cold air into stores of potato or other root crops.

So far as tropical crops are concerned, it will be possible with this mobile unit to organise the drying of produce in a number of different centres on successive days. The drying table can take up to 80 bags of produce and dry them by forced draught in from 12–24 hours, according to the moisture content and nature of the product. The machine would appear to be particularly suited to the drying of copra, paddy, coffee, pepper, cocoa beans, groundnuts, cashew nuts, pulses and *gaplek*.

Teles Smith Ltd. were displaying their chain saws, saw benches and 'Tiger' hedge cutters. Shown for the first time was a pneumatic chain saw, fitted with a powerful rotary-vane-type motor, which is available with cutting widths of 18 or 22 in. Their latest petrol-driven chain saw, the 'Little Tiger', can be operated by one man and will deal with logs up to 22 in. in diameter.

E. V. Twose Ltd., manufacturers of agricultural implements, were displaying two new implements—their grain, pea and bean drill is designed for attachment to the Twose toolbar.

The 'Tarpentrimmer' cutting a hedge of holly

The Teles 'Little Tiger' chain saw at work

W. Tyzack, Sons & Turner Ltd. Implements on display included machine sickles for mowers, binders and combine-harvesters; disks for ploughs, harrows and drills; disk coulters; plough breasts and fittings; cultivator points and shares and other cutting parts for agricultural machines. Hand tools included scythe blades, knives, reaping hooks, files and saws.

V

The *Villiers Engineering Co. Ltd.* Their wide range of air-cooled and petrol-paraffin power units included a selection of J.A.P. agricultural engines, ranging from a tiny 34-c.c. 2-stroke of ⅓ b.h.p. to a 824-c.c. twin-cylinder 4-stroke which can develop up to 15 b.h.p. Amid all this array of power, the Mk. 7 4-stroke was making its first appearance; it is of 74.63 c.c. capacity and can develop 1.2 b.h.p. at a speed of 3,600 r.p.m.

W

John Wallace & Sons. Two machines exhibited for the first time were the 'JF' power-driven manure spreader and a down-the-row thinner. In the manure spreader the usual three or four beaters are replaced by a single rotor and the manure is driven through strong steel tines to obtain fine disintegration. The thinner is a 4- or 6-row power-driven machine; reciprocating blades remove surplus plants at regular intervals and depth is controlled and drills are cleaned by an open cultivating wheel.

Watson Sprayers Ltd. Their new mistblower-duster is an air-assisted

low - volume and semi - concentrate sprayer, which can also be used for powder dusting. Variation of the nozzle output is obtained by a turn of the caps; for higher volumes, interchangeable caps can be fitted in a few minutes. Besides being versatile in operation, it can also be switched from spraying high trees to vines, to bush fruits or to row crops, or it can be used for dusting potatoes, strawberries or vegetable crops, simply by varying the hood and adjusting the fan casing. The machine is fully tractor-mounted and so is easily manoeuvrable in confined spaces without loss of working time.

Weathershields Motor Equipment Ltd. A variety of cabs for the leading makes of tractors were shown; these included the newly-designed cab for the Ferguson FE.35 tractor.

The new Whitlock combined mill and mixer

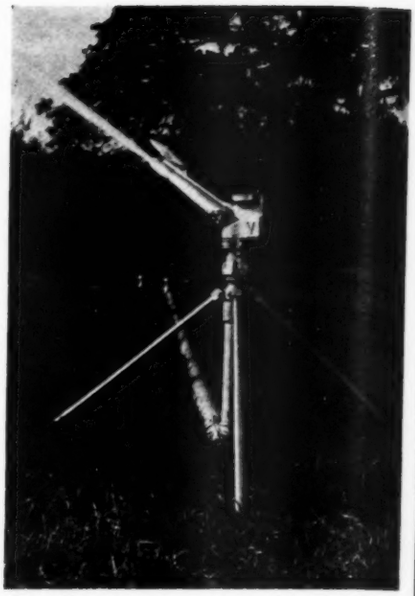
Whitlock Bros. Ltd. Machinery exhibited included a new combined mill and mixer and a new conveyor for grain. The 10-cwt. capacity mill is fitted alongside the mixer. When grinding is complete, the mill is automatically switched off and simultaneously the mixer starts, and this, too, cuts off automatically when the mixing operation is completed. The new vibrationless conveyor is designed to move grain at the rate of 12 tons per hour and it requires only ½ h.p. for every 25 ft. of run. It can also be used at an inclined angle of 10° without any great loss of capacity.

M. B. Wild & Co. Ltd. Featured on this stand was a new silage harvester. Designed to pick up grass and similar silage crops direct from previously cut swaths and load them into a trailer or vehicle running at the side or rear, it is a semi-mounted machine supported at the front by the lower links of the tractor's hydraulic system and at the rear by two pneumatic castor wheels, enabling tight turns to be made. Loading is at the rate of 8–10 tons per hour. Wild-Thwaites muck spreaders, a muck loader and the Wild-Thwaites forage harvester were also on display.

Among the exhibits of *John Wilder Ltd.* the ' Multi-Masta ' chopper took pride of place. This new machine will mow, chop and deliver into any type of trailer, drawn behind, all silage crops; it also provides an easy means for the disposal of straw, potato haulm, vegetable stalks and other vegetable wastes after cropping. Other versions of the ' Multi-Masta ', *viz.* the ' Sila-Masta ', the ' Straw-Masta ' and the ' Haulm-Masta ', were also on display. Other exhibits were a mounted ' Pitchpole ' self-cleaning cultivator, a Wilder drag cultivator and the Wilder-Steed windproof loader for the speedy loading of green crops—grass, silage crops and green peas—under any conditions of weather and crop.

Wolf Electric Tools Ltd. were showing a complete range of industrial and domestic portable electric tools of interest to the agricultural engineer and farmer. Among these were the new ½-in. general-duty, two-speed drill, type TS24c, for general farm maintenance work; the new ' Quartermaster ' power equipment, a handyman unit for sawing, sanding and polishing operations; the chisel mortiser, type NM4; the SR54 heavy-duty valve refacer for servicing petrol or diesel engine valves; and the VR5 precision valve refacer for the small repair shop.

Wolseley Engineering Ltd. introduced the ' Merry Tiller ', a new type of rotary cultivator, powered by a 4-stroke, 75-c.c. petrol engine, which develops about 1 h.p.—the ' Suffolk Punch ' unit. The gentle stirring action of the finger-shaped tines, which operate at less than 100 revs. per min., prepare the soil without excessive pulverisation. The machine will cultivate to a depth of 10 in. and to a width of 12 in.; extension rotors are available to increase the cultivator width up to 24 in. A range of special implements included a mowing machine, a ridger, hoe blades and cultivating feet.



The Wright Rain ' Vector ' sprinkler is equally suitable for flat ground or hillsides

The *Wright Rain* ' Vector ' sprinkler introduces a novel method of rotation to produce circular and sector patterns of artificial rain; it has been specially designed to meet the special needs of tropical crops, such as tea, coffee, bananas and sugar-cane and would be suitable for the watering of rubber, coconut and forest nurseries. It is a tripod - mounted sprinkler, which weighs only 13 lb. and will handle liquid manure equally as well as clear water. The fact that it can be adjusted to water either a full circle or a part circle is of particular advantage when irrigating in areas subject to strong winds, or when operating on the slope of a hill. This company were also exhibiting their ' T2 ' tractor pump, mounted on a 2-wheel trolley, for use with small sprinkler irrigation systems.

Aerial Spraying

Aircraft of Crop Culture (Aerial) Ltd. have a 70,000-acre spraying contract in West Africa. The planes will be spraying a special fungicide on banana plantations to fight the leaf-spot disease which is seriously endangering the crop in the area.

The aircraft are fitted with the special ' Micronair ' rotary atomisers, which give the extremely fine spray which is essential to prevent scorch of the bananas.

This same type of equipment was used for the first time in England last year when several thousand acres of potatoes were sprayed from the air against blight with copper in oil.

NEW PUBLICATIONS

Agricultural Co-operation Selected Readings

Edited by M. A. Abrahamsen and C. L. Scroggs. Pp. 576. Minnesota University Press. London: Oxford University Press. 1957. 60s.

The growth of co-operation in the U.S.A. is astonishing and its present position one of great importance in the economy of American production and marketing. This is sufficient justification for a volume which presents the more important developments in agricultural co-operation in that country and enables the reader to compare the various points of view concerning the movement over the past decade or so.

In this weighty volume (2 lb.) are 54 articles by 49 contributors from varying branches of American co-operative activity. It is probable that the editors could have written the substance of this book in shorter compass and so achieved a conciseness which is missing from the present volume. One would have valued also the personal views of the editors on these diverse subjects. This is not to say that the articles are inadequate; they are, in fact, judiciously selected and systematically classified so that the reader may readily find authoritative articles on many aspects of the co-operative movement in America.

The book is divided into three sections, in the first of which the history and objectives of co-operation are traced and its philosophy, theory and principles expounded. The second section, under the title ' Co-operation in the Modern Economy ', consists of 19 articles dealing with Government policy and legislation, conflicting interests in the movement, and the relations of co-operation with other businesses. The third section includes articles which take an objective view of the achievements of co-operation. There are four short appendices and a comprehensive index.

The uninitiated will perhaps find the widely divergent views on the basic principles of these organisations somewhat confusing. Pruned of exaggerated altruistic motives expressed from time to time, co-operation emerges as industrial groups adjusting production and marketing in their own interests. It is true that, efficiently organised, their efforts should also be to the benefit of the consumer at the expense of middlemen. Co-operators, at least in America, appear to accept the principles of capitalism, including the right of private property, inheritance and private enterprise. Furthermore, they are in substantial agreement with ordinary business firms in opposing the encroachment of Government in business. They are thus shown to be a phase of the capitalistic free enterprise. The co-operator's main objection to capitalism, however, is the amassing of excessive dividends for the benefit of promoters rather than as rewards for workers.

One is left with the impression that those in authority in the co-operative movement are not sufficiently sure how to handle the huge and still growing giant of their creation. It would seem that control can only be assured as the result of constant propaganda directed to their members to assure some understanding of the movement and loyalty for it, coupled with intensified research which ' is becoming an increasingly important tool for co-operative management in policy making '.

One imagines that the hierarchy of co-operatives and teachers of co-operation are likely to be fully conversant with the views expressed by the writers of these articles. The book has, however, been prepared in response to the growing interest in the subject and to aid teachers and students. The latter, at least, should appreciate this book; it should teach them much and assist them in formulating their own opinions.

D. H. GRIST

The Nutrient Status of Some Coconut Soils of Ceylon

By T. B. Paltridge and K. Santhirasegaram, with an appendix by Beryl Salmond. Bulletins Nos. 11, 12, 13 and 14, totalling 107 pp., illustrated. Coconut Research Institute of Ceylon. 1957.

The so-called ' cinnamon sands ' of Ceylon are to be found in areas where, in a few cases, cinnamon used to be grown as a leading cash crop, to be substituted later by coconuts. Coconuts, however, do not do well in these thin soils, which do little more than provide an anchorage for their roots, and there is little response to the application of NPK fertilisers. Soils of this type have offered a problem to which hitherto there has been no effective answer.

It is essentially a leached sand with a hard pan or clay layer, occurring at a depth of approximately 5 ft. Drainage is poor and in wet seasons free water rises to within 6 in. of the surface. This soil has now been examined for nutrient deficiencies by means of test plants—a perennial pasture grass and two legumes, using the pot technique, as previously described (WORLD CROPS, 1957, **9**, 401).

The data shows that this is a soil in which a balanced mixture of nutrients is essential. The test plants showed that there was an acute deficiency of potassium, of calcium, and of nitrogen. There was also a deficiency of sulphur and of lesser deficiencies of phosphorus and magnesium. The legumes suffered from a deficiency of boron with indications of some deficiency of copper. The optimal doses for the growth of these plants are given.

Assuming that coconut palms will have the same or a similar demand for these nutrients, the authors recommend that expenditure might be reduced by applying a recommended mixture of these seven nutrients, first in small manure circles and in later years in ever-widening circles until the entire surface has been treated. The initial recommendation is $4\frac{3}{4}$ lb. per tree. Subsequently, the mixture might need to be modified in view of residues, as the experiments have shown that the use of unbalanced fertiliser mixtures could do considerable harm. The use of green manures as a source of nitrogen and to build up the soil is strongly recommended.

The effect of nutrients on the root system of the legume, *Phaseolus lathyroides*, growing in ' cinnamon sand ', has been studied by the third author. In the other bulletins the authors have described similar studies with lateritic loam, lateritic gravel, lateritic sand and a virgin forest soil, which was surprisingly found to be deficient in certain plant foods.

F. C. COOKE

FAO Publications

International Directory of Agricultural Engineering Institutions. This directory provides information on research and training facilities and on government services in 74 countries of the world in the field of farm power and machinery, rural electrification,

engineering in land development, irrigation and drainage, farm buildings and farm work organisation. It will help those engaged in agricultural engineering to know who else works in the same field, what problems are being studied, what results have recently been obtained and where published.

The main part gives the names and addresses of central governmental services and of national and international institutes of agricultural engineering and their staff, with reference to the type of activity and special work in progress, recent publications issued, and languages which may be used for correspondence. This information is given either in English, French or Spanish, according to which of these is the official language of the country concerned at FAO.

The second part lists the national associations of farm equipment manufacturers and distributors, meetings and shows, periodicals, recent textbooks and films concerning agricultural engineering. Price 5*s*. or $1.00.

Report of the Fourth Regional Conference for Latin America, held at Santiago, Chile, in November 1956. Items under consideration were recent developments in the food and agricultural situation, the work of FAO in the region, major policy questions of interest in the region and the future orientation of FAO's work in Latin America. It was found that in the two years under review the expansion of agricultural production had only just kept pace with the rapid growth of population in the region. Price 5*s*. or $1.00.

Tree Planting Practices in Tropical Africa, Forestry Development Paper No. 8, is one of the geographical sections of the 'World Forest Planting Manual' and deals with the seed, nursery and planting practices in the tropical zone of Africa—many of which practices are still in the development stage. The methods most commonly employed have been outlined and a summary of the characteristics of the species most frequently planted is given. Price 15*s*. or $3.00.

Yearbook of Forest Products Statistics. The yearbook contains production and trade data from 135 countries and territories and is the most comprehensive report yet published. Although little change was recorded in the total timber harvest from the world's forests, the output of wood for industrial purposes in 1956 increased by about 20 million cu. m. (2%) over that of 1955. The estimated market value of all the main primary forest products reached $27,700 millions, surpassing by $600 millions the value of these products in 1955. The total world sawnwood output in 1956 was slightly more than 295 cu. m., of which coniferous species accounted for about 80%. The U.S.A. was the leading producer with 88.5 million cu. m., the Soviet Union followed with 76 million and Canada reported 19 million. Price 12*s*. 6*d*. or $2.50.

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Technical Books,
308 Euston Road,
London, N.W.1
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Cocoa

The *Report on Cacao Research*, 1955–56, of the Imperial College of Tropical Agriculture, Trinidad, B.W.I., contains the following papers: 'Some Early Observations on Seedling Progenies'; 'An Analysis of Field Variation in a Sample of Cacao Trees'; 'Deficiency Levels of the Major Nutrients in Cacao Leaves'; 'Nutrient Uptake by Excised Cacao Roots'; 'Leaf Symptoms of Deficiencies of Calcium and Magnesium in Cacao'; 'The Nutrition of Cacao'; 'The Growth Substances of *Theobroma cacao*'; 'A Comparison of Various Methods of Rooting Cuttings'; 'Shade Trees for Cacao'; 'Further Observations on the Susceptibility of the Imperial College Selections to Witches' Broom Disease'; 'A Note on the Effect of Maleic Hydrazide Sprays on Cacao Seedlings and Cuttings'; 'Nitrogen Metabolism in Fermenting Cacao'; 'The Application of Research to the Cocoa Industry'.

Obtainable from the Imperial College or from their London office at 40 Norfolk Street, W.C.2, price 15*s*.

Notes on Cocoa in Some Countries of South-East Asia and the Pacific (Ceylon, Hawaii, Thailand, Malaya, Papua and New Guinea, the Fiji Islands). The report by D. H. Urquhart (former Director of Agriculture, Gold Coast) on his visit to these territories was prepared for and published by Cadbury Brothers Ltd. His notes deal with such subjects as history of the industry in the various countries, cultivation practices, yields, and the possibilities of expansion. Price 5*s*.

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Potato Handbook

The 1957 edition is a special disease control issue and, apart from the usual information provided listing sources of certified seed etc., includes articles on the control of common scab, ring rot, *Verticillium* wilt, late blight, virus diseases, southern bacterial wilt, control by spraying and the control and prevention of potato disease through seed certification programmes.

Published by the Potato Association of America, New Brunswick, New Jersey, price for single copies $2.00; 2–10 copies $1.00, 10–50 copies $0.50, and over 50 copies $0.25 each.

*

Forestry Careers

Forestry is the subject of the latest illustrated booklet in the British Central Youth Employment Executive's 'Choice of Careers' series. The Forestry Commission employs more than 12,000 workers and several thousand more work for landowners or timber merchants. The booklet describes the day-to-day work of men in the different grades of the forestry service, and explains the openings for training and the qualifications required. Mention is also made of posts outside the Commission at home, and opportunities abroad.

Published by H.M.S.O., No. 81, price 1*s*. 9*d*.

To Authors and Readers

The publishers of WORLD CROPS invite the submission of manuscripts of books to be considered for publication. All manuscripts will be promptly acknowledged and carefully considered by qualified experts. A synopsis with chapter headings should be sent in the first instance, addressed to the Book Production Manager.

The publishers are specialists in industrial, technical and scientific books and have a world-wide selling and distributing organisation.

Agricultural Chemicals

Fungicide, weedkiller and pesticides

Soil Sterilisation

Glasshouses are cropped very intensively, often producing the same crop year after year; this leads to an accumulation of pests, diseases and harmful soil organisms—a condition loosely described as 'soil sickness'. Partial sterilisation, with steam or chemicals, has to be done regularly, if these are to be kept under control; but chemical sterilisation is cheaper and quicker than steaming and does not affect the soil structure.

'Novo' is a cresylic type of steriliser, containing 40% of tar acids and offered in the form of a free-flowing emulsion which can be readily diluted with water to make a stable solution. The acids can thus be evenly distributed throughout the soil with no danger of irregular application or local over-concentration.

This product is an efficient soil insecticide and it also has fungicidal properties, but it does not control eelworm.

'Novo', a product of the Murphy Chemical Co. Ltd., can be used for sterilising glasshouse and potting soils and flower pots and seed boxes; for washing down plant houses and mushroom sheds; and for the summer watering of tomatoes.

*

Destruction of Rabbits

Myxomatosis has given us a unique opportunity to make a permanent end of the colossal crop losses caused by rabbits, but the pest is again beginning to reappear and, unless these few are eliminated at once, they will rapidly build up in numbers again.

The animal breeds from four to eight times a year, bringing forth each time from three to eight young, most of which survive to multiply in almost geometrical progression. It will thus be appreciated that numbers will increase rapidly once it gets a footing.

It is to be feared that the rabbits now again appearing are the progeny of those which were resistant to the ravages of the disease and the need to use a chemical exterminator on these fast-breeding vermin is obvious. They can be destroyed cheaply and quickly by gassing with 'Cymag', manufactured by Plant Protection Ltd.

Reader Service

For further information on any item reviewed in this issue please write to:

Reader Service
WORLD CROPS,
Leonard Hill House,
Eden Street, London N.W.1,
England

Control of Cleavers

Cleavers, *Galium aparine*, known under a variety of common names—goosegrass, herrif, erif, burs, sweethearts, clites, clivers, sticky willy, beggar-lice and robin-run-the-hedge—and formerly found mainly in the hedgerows, has now become a serious weed in corn crops, as the seed pods will contaminate the grain and will attach themselves to the coats of farm animals.

Being resistant to MCPA and 2,4-D (see WORLD CROPS, 1957, **9**, 459), this weed has spread while other weeds have decreased and it is now one of the farmer's most serious problems. With the introduction of 'Weedol', by Bayer Agriculture Ltd., the advantages of the hormone weedkillers are now extended to the control of cleavers. This product will control a range of weeds and is particularly recommended against chickweed, *Stellaria media*.

It can be applied easily and safely through low-volume machines, it does not check the crop and the spray is harmless to game and livestock. It is safe to spray cereals with it at any time after the four-leaf stage until the beginning of heading, but to obtain best results it should be applied when growing conditions are good and the weeds are in their most susceptible stage of growth.

*

Wood-boring Insects

Wood-boring insects can be controlled by the application of RIS woodworm liquid (B 420). The insecticide should be applied by paint brush, spray gun or sprayer to infested woodwork, after all dust and debris has been removed; two applications are necessary to ensure that the wood absorbs the liquid to its full capacity.

For inaccessible points in attics, lofts and cellars the use of smoke generators, Nos. 22 and 25, which contain 'Gammexane' is advised. Monthly treatment for a period of two or three years is necessary for the common furniture beetle and the powder-post beetle and for seven years for the death-watch beetle. Ratsouris Ltd. are suppliers of these materials.

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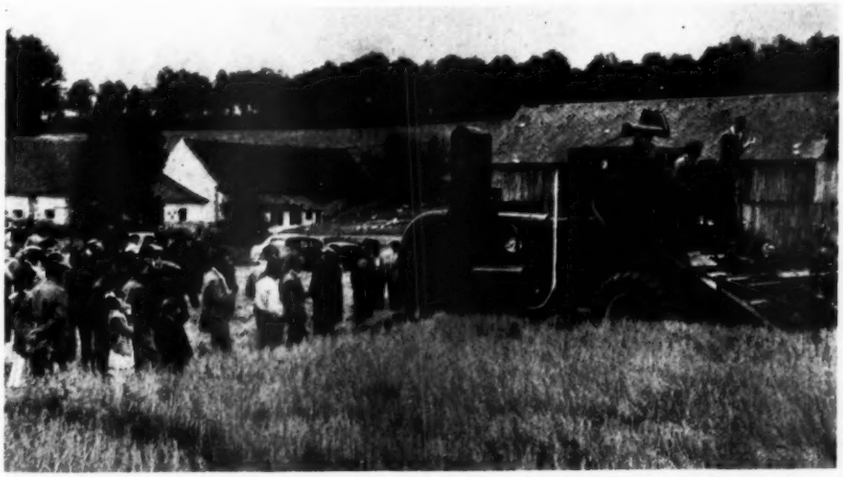
A B C of Weedkillers

To the list of organic herbicides already published—see WORLD CROPS, 1957, **9**, 459—should be added 'Amizol'—amino triazole, which is the principal constituent of 'Meeno', an effective defoliant for cotton, produced by the American Chemical Paint Co.



Demonstration of a combine-harvester at Chêne Arnoult, a typical French farm selected by Shell Française to show the many uses of oil in agriculture (see over)

Seeds and Supplies

Oil Aids Agriculture

One of the farmer's most necessary requirements today is oil, and the oil industry is now actively intensifying research into agricultural problems. The field for research is vast and the range of farm products under review is prodigious: they may be different types of oils required for farm machinery or equipment, or else valuable chemical substances, scarcely recognisable as having been derived from crude oil, when transformed into weedkillers or nitrogenous fertilisers.

Oil is the prime mover on the modern farm—its products provide power for tractors, farm vehicles and combine-harvesters; keep the farm machinery and processing equipment running smoothly; and prevent corrosion and destruction when the machines are idle or laid up out of season.

Kerosene is used for incubators, for oil-burning stoves in greenhouses, and as a carrier for toxic substances used as sprays. White oils are used as sprays on fruit trees, not only to asphyxiate the insects, but also to destroy their eggs.

Shell petroleum products can be used to keep farm animals and other livestock healthy. Skin irritation is prevented by the application of technical white oils in ointments or cream foam. There is also a special pig oil which, besides preventing scurf, makes the skin softer and gives the animal a sleek shining appearance. Sprays and dips, too, may have an oil base.

Other uses for the products of petroleum on the farm are bitumen for roads, floors and walls and to protect galvanised iron, fence posts and barbed wire; paraffin wax for coating cheese; and special oils used in refrigeration that remain fluid at 70° below zero 0°F.

•

Sugar-beet Seed

Since the Hilleshog sugar-beet was first introduced into England, just over 25 years ago, there has been a continuous improvement in performance as a result of the work done at the Hilleshog Sugar-Beet Research Institute in Sweden and its subsidiary Research Station at Brooke, near Norwich, which was established in Norfolk in 1936.

The juice purity and sugar content of the Hilleshog strains today are exceptionally high, the former ranging from 16.4–16.7%, and the latter from 87.07–87.23%, according to the results of the 1956 National Sugar-beet Trials. The calculated yield of sugar per acre ranged from 106 to 110 *i.e.* tonnage x sugar content, as compared with the index average of 100 for other varieties. The bolting tendency has been corrected, so that the shape of the Hilleshog beet now lends itself admirably to mechanical lifting. Other main lines of research are aimed at improving the tolerance to virus yellows and other diseases of the sugar-beet.

To get the best results, it is advisable not to sow the polyploid seed too early, as it requires a long growing season. It should also not be lifted too early, as it maintains its peak sugar content later in the season than other diploids.

The feature
WORLD CROP REPORTS
will be resumed next month

Damage to Seed

Bean seeds are very susceptible to damage during harvesting, threshing and cleaning, which may seriously impair or even destroy their capacity to germinate or to grow into productive plants. Sometimes mechanical injury can be detected from external symptoms, such as a damaged seed coat. Often, however, the injury takes place within the seed and shows no external symptoms.

Low germination due to mechanical injury is not a new problem. Dry conditions result in lower seed moisture content at harvest time and make seeds more susceptible to injury during threshing and cleaning, a tendency aggravated with the change from the stationary thresher to high-speed single-cylinder combines.

In an effort to find a solution to the problem, the Asgrow Department of Breeding and Research undertook an extensive series of studies to find some of the causes of low germination resulting from mechanical injury and to develop ways to eliminate them. The results of these investigations were published in 1949 in *Asgrow Monograph No.* 1, ' A study of Mechanical Injury to Seed Beans ', The desirable features of many new varieties, including multiple disease resistance and heavier yielding ability, have tended to outweigh the defect of susceptibility of the seed to mechanical injury, and for some time Asgrow scientists have been engaged in a further extensive programme of research in plant breeding, plant physiology, agronomy and agricultural and mechanical engineering to find a better answer, both in varieties and in handling methods.

In the meantime, it is important to remember that, no matter how carefully the seed producer handles these ' problem ' varieties, his efforts can be cancelled by careless handling, since bean seed germination drops every time the seed is handled.

Their findings underline the importance of careful handling in the warehouse and on the farm and of the need for special packaging. Their significance for the grower in wasted money and erratic stands needs hardly be mentioned.

Tree Seed

Poland at present covers the import of a good quantity of seed for fodder crops by exporting seeds of pine, fir and oak. Among her customers are the U.S.A., the U.K., Denmark, Sweden and Belgium. So far this year the sale of tree seeds has covered the import of $800,000 worth of maize, clover, vetch and sunflower seed from Denmark and Holland, and before the end of the year it is anticipated that deliveries from Britain and Holland to the value of $500,000 will be made.

Technical News

Articles in other journals of the Leonard Hill Technical Group include the following:

Dairy Engineering.—' Liquid Milk in Many Forms ', ' Slot Machines for Higher Milk Sales ', ' More Milk Powder for Less Labour ', ' Continental Experiences with Milk Cartons '.

Food Manufacture.—' Packaging—a survey of developments in 1957 ', annual reviews of brewing, sugar confectionery and pickles and sauces, 'The Evolution of Container Closures'.

Corrosion Technology (a special issue on pipelines).—' Underground Corrosion—Part 1, Corrosion Mechanism of Metals in Soil ', ' The Protection of Steel Structures in Salt Atmospheres', 'Humidity and Temperature Test Cabinets '.

Manufacturing Chemist.—' Review of Filters ', progress report on fertilisers and nutrients.